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***FINAL***

**SITE INVESTIGATION  
REPORT  
FORMER RIVERSIDE  
MILLS BROWNFIELDS  
SITE**

**Providence,  
Rhode Island**



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This Site Investigation Report (SI) summarizes analytical results of soil and groundwater sampling at the Former Riverside Mills Brownfields Site, in Providence, Rhode Island. Analytical results of soil and groundwater were compared to applicable RIDEM criteria to determine the magnitude of the contamination at AOCs #1 and #2.

TPH, VOCs, and SVOCs were detected in both the subsurface soil and the groundwater. Remedial alternatives were then evaluated for both the site soil and groundwater. Based on the data obtained during the SI, the Natural Attenuation (NA) alternative may be viable for AOC #2. However, for expediency, the excavation of separate-phase oil and associated contaminated soil at the elevation of the water table has been chosen as the preferred remedy for AOC #1 and the adjacent AOC #2.

The planned future use of the property is for it to become part of a proposed 4.4-mile greenway and bike path along the Woonasquatucket River.

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# FINAL SITE INVESTIGATION REPORT FORMER RIVERSIDE MILLS BROWNFIELDS SITE

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## 1.0 EXECUTIVE SUMMARY

Harding Lawson Associates (HLA), under contract to Battelle (Subcontract Number G339639), has prepared this Site Investigation (SI) Report for the U.S. Army Corps of Engineers, New England District (USACE-NAE). This SI Report summarizes analytical results of soil and groundwater sampling recently completed at the Former Riverside Mills Brownfields Site, located in Providence, Rhode Island (Figures 1-1 and 1-2). The project was conducted under the direction of USACE-NAE, 696 Virginia Road, Concord, Massachusetts, 01742-2751. The USACE-NAE Project Manager is Ms. Lauren Borocharner.

This investigation was undertaken as part of the U.S. Environmental Protection Agency (USEPA)'s Brownfields/Showcase Communities Program. The tasks detailed in this SI Report are described in the USACE-NAE's *Statement of Work for Site Investigation, Former Riverside Mills Brownfields Site, Providence, Rhode Island* dated July 20, 1999, and revised August 19, 1999. In 1996 and 1997, as part of a Brownfields Pilot Project, the Rhode Island Department of Environmental Management (RIDEM) conducted a remedial evaluation of the property. Analytical results of soil, groundwater, and soil gas samples collected at the site were compared to applicable RIDEM criteria. Following several field investigations, RIDEM identified five Areas of Environmental Concern (AOCs). This SI addresses data gaps in two of the five AOCs (AOCs #1 and #2), thereby completing the understanding of the areal and vertical extent of contamination at the site.

SI field activities completed in 1999 included a visual site inspection, the advancement of seven soil borings, installation and development of four new monitoring wells, redevelopment of three existing monitoring wells, and soil and groundwater sampling and analyses.

Observations made during the drilling program include the following:

- At deep boring location SB99-1, obvious evidence of contamination (e.g., odors, staining, or elevated headspace measurements) was not observed below 10 feet below ground surface (bgs). This boring extended to a depth of 56 feet bgs, and bedrock was not encountered. Soil observed consists of poorly graded medium sand with minor variations to fine and silty sand with depth.
- The 8- to 10-foot bgs soil sample collected at SB99-2 exhibited a slight sheen and a strong odor. This depth interval also corresponded with the highest volatile organic compound (VOC) head space measurement, 396 parts per million (ppm). Below 12 feet bgs, total VOCs in headspace dropped significantly. Groundwater at this location was observed at a depth of approximately 7 feet bgs.
- No odors or staining were noted in samples from SB99-3, although measurements of total VOCs in headspace were up to 295 ppm (7 to 9 feet bgs).
- An oil-like material accompanied by a strong odor was observed at SB99-4, at a depth of 10 feet bgs. This depth corresponds to the observed water table. Total VOCs in headspace of the 8- to 10-foot sample were 412 ppm.
- At SB99-5, a strong fuel-like odor was noted in the 4- to 6-foot sample.
- Obvious contamination was not observed at locations SB99-6 and SB99-7.

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## SECTION 1

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Monitoring wells MW99-5 through MW99-8 were installed upon completion of four of the soil borings (SB99-3 through SB99-6). To determine the extent of contamination at AOCs #1 and #2, and to determine the potential for transport of contaminants to the Woonasquatucket River, soil and groundwater samples were collected and analyzed for total petroleum hydrocarbons (TPH), VOCs, and semivolatile organic compounds (SVOCs). Two types of groundwater samples were obtained during the SI field program:

- Grab groundwater samples were collected directly from two of the soil borings (SB99-1 and SB99-2), and
- Low flow groundwater samples were collected from each of the four new monitoring wells (MW99-5 through MW99-8) as well as three existing monitoring wells (MW-1 through MW-3). These samples were collected in accordance with the *USEPA Region I Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (USEPA, July 30, 1996a).

A total of 8 soil samples and 9 groundwater samples (including the grab samples and the low flow samples) was submitted to the contract laboratory for analysis of TPH, VOCs, and SVOCs. The following sections summarize analytical results of samples collected during the SI field program.

### SOIL

Three VOCs were detected in soil samples, but all at concentrations below RIDEM Direct Exposure Criteria (both Residential [R-DEC] and Industrial/Commercial [I/C-DEC]) and RIDEM GB Leachability Criteria (GBLC): cis (1,2)-dichloroethene (cis-DCE), tetrachloroethene (PCE), and trichloroethene (TCE). No other VOCs were detected in soil. Low concentrations of several SVOCs (primarily polynuclear aromatic hydrocarbons [PAHs]) were detected in soil samples, although only two of the samples had SVOC concentrations which exceeded R-DEC: the 8- to 10-foot sample from SB99-2, and the 7- to 9-foot sample from SB99-3. No SVOCs were detected at SB99-1, SB99-5, SB99-6, or SB99-7.

TPH was detected at all but two locations. Gasoline-range organics (GRO) were detected in three samples, at concentrations ranging from 3.5 milligrams per kilogram (mg/kg) (SB99-5, 8 to 10 feet bgs) to 130 mg/kg (SB99-2, 8 to 10 feet bgs). Diesel range organics (DRO) were detected in seven samples, at concentrations ranging from 84 mg/kg (SB99-1, 4 to 6 feet bgs) to 1,700 mg/kg (SB99-5, 8 to 10 feet bgs). The R-DEC for TPH is 500 mg/kg, the I/C-DEC is 2,500 mg/kg, and the GBLC is 2,500 mg/kg. The DRO/GRO analytical results from the modified USEPA Method 8015B used in the 1999 Site Investigation can be added together for a total concentration that equates to the TPH measurement, but cannot be readily comparable to the previous 1996-1997 investigation when USEPA Method 418.1 was used.

The depths at which the highest analyte concentrations were detected in subsurface soil, approximately 7 feet to 10 feet bgs, generally correspond to the water table depth and may be indicative of seasonal water table fluctuations. Analytes in soil may represent a continuing source of groundwater contamination.

**GROUNDWATER**

TPH and SVOCs were detected in only one groundwater sample: the grab sample from SB99-2. This sample contained DRO at a concentration of 4 J milligrams per liter (mg/L), and GRO at a concentration of 0.59 mg/L. Most of the detected SVOCs were PAHs. VOCs, primarily chlorinated solvents, were detected in every groundwater sample, although only one sample (and its duplicate) contained VOCs at concentrations that exceeded RIDEM GB groundwater objectives: MW99-5. This low flow sample and duplicate sample contained 1,1-dichloroethene (1,1-DCE), cis-DCE, and TCE at concentrations well above GB groundwater objectives.

Based on water level measurements made during the SI, groundwater below the eastern portion of the site flows southeastward, toward the Woonasquatucket River (see Figure 4-5). The water table is present at a depth between 6 feet and 9 feet bgs. Given the detections of analytes in groundwater, the shallow groundwater depth, and the proximity of the monitoring wells to the river, the potential exists for site-related contaminants to migrate to the river.

During the 1996-1997 RIDEM remedial evaluation, separate-phase product was observed on the surface of groundwater infiltrating several test pits. The presence of this free-phase product defined AOC #1. During the 1999 SI field program, however, no nonaqueous-phase liquid (NAPL) was measured in any of the four new monitoring wells or three existing wells (MW-1 through MW-3), although an oil-like material was noted coating soil grains at boring location SB99-4 (10 feet bgs). These borings were drilled at the perimeter of the AOC.

**EVALUATION OF REMEDIAL ALTERNATIVES**

Evidence of active natural biodegradation of the chlorinated solvents was revealed by the groundwater data. Degradation products of TCE (cis-DCE, and vinyl chloride [VC]) were found in every groundwater sample at levels that are greater than TCE, the parent compound. Furthermore, the concentrations of total ethenes (in terms of equivalent TCE) have decreased substantially (87% reduction at MW-2 and 92% at MW-4) from 1997 to 1999. The concentrations of chlorinated ethenes exceeded RIDEM GB groundwater objectives in 1997, but were below these standards at the end of 1999. If the rate of natural attenuation observed over the past two and a half years at MW-2 is applied to the concentrations observed in 1999 at MW99-5, it could be expected that these concentrations would degrade to less than the objective within approximately two years.

Potentially feasible remedial alternatives have been identified for soil and groundwater at AOCs #1 and #2. These potential alternatives were developed by RIDEM based on the following assumptions:

- the uppermost two feet of contaminated soils at the site shall be remediated to RIDEM's R-DEC;
- that contaminated soils below two feet at the site shall be remediated to RIDEM's I/C-DEC, and that the majority of the site will be encapsulated in some manner to prevent direct exposure to any remaining contaminated soils;
- that soils above the groundwater table shall be remediated to RIDEM's GBLC; and



## SECTION 1

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- that an Environmental Land Usage Restriction (ELUR) shall be placed on the property to ensure that it is not subsequently developed for residential uses without addressing contamination in soil.

In the vicinity of AOCs #1 and #2, the planned future use of the property is for it to become part of a proposed 4.4-mile greenway and bike path along the Woonasquatucket River.

NAPL was not encountered in any of the soil borings drilled at the perimeter of AOC #1 during the 1999 SI. The absence of free-phase product at these locations could indicate that either (1) floating product apparently does not occur outside of the limits of the AOC, as identified in 1997, or (2) this plume has decreased in size by natural attenuation.

Three remedial alternatives were evaluated to address AOC #1, as presented in the 1997 Remedial Evaluation Report. These alternatives included:

- Excavation of Separate-Phase Oil and associated Contaminated Soil at Water Table
- Separate-Phase Oil Recovery (Total Fluids Pumps), and
- Separate-Phase Oil Recovery (Trenches using Product Only Pumps)

The remedial alternative selected by RIDEM was the excavation of contaminated soils. Although this was more expensive than the two in-situ alternatives, this will support on expedited remediation of the site for redevelopment as a greenway along the river.

Following completion of the 1999 SI sampling and analysis program, the potential remedial alternatives proposed for AOC #2 in the Remedial Evaluation Report are still appropriate as well as additional remedial alternatives identified within this Site Investigation Report. These alternatives include:

- No Action/Natural Attenuation with Risk Assessment,
- Dual-Phase Extraction,
- Soil Vapor Extraction and Air Sparging,
- Enhanced Biodegradation,
- Passive/Reactive Treatment Wall, and
- Excavation of Contaminated Soil at Water Table (extension of AOC #1)

Based on the data obtained during the SI, the Natural Attenuation alternative may be the most favorable for AOC #2. Natural attenuation has already occurred, and conditions apparently remain favorable for natural attenuation. The NAPL plume (AOC #1) is likely commingled with the area of VOCs in groundwater (AOC #2), and is a likely carbon source supporting anaerobic biodegradation of VOCs.

However, for expediency, the excavation of separate-phase oil and associated contaminated soil at the elevation of the water table has been chosen as the preferred remedy for AOC #1, and AOC #2. It makes sense to extend the excavation of soils at the elevation of the water table to the adjacent areas at AOC #2 that show exceedences of the TPH criteria. This will immediately reduce the soil TPH contamination to below applicable criteria, and therefore make this alternative preferable to the others which require a much longer time frame to achieve regulatory cleanup goals.

## **2.0 GENERAL**

This SI Report summarizes analytical results of soil and groundwater sampling recently completed at the Former Riverside Mills Brownfields Site, located in Providence, Rhode Island (Figure 1-1). The project was conducted under the direction of USACE-NAE, 696 Virginia Road, Concord, Massachusetts, 01742-2751. The USACE-NAE Project Manager is Ms. Laureen Borocharner.

### **2.1 INTRODUCTION**

This investigation was undertaken as part of USEPA's Brownfields/Showcase Communities Program. The tasks detailed in this SI Report are described in the USACE-NAE's *Statement of Work for Site Investigation, Former Riverside Mills Brownfields Site, Providence, Rhode Island* dated July 20, 1999, and revised August 19, 1999.

Past activities at the site of the former mill have resulted in chemical contamination at several areas. As part of a Brownfields Pilot Project, RIDEM conducted a remedial evaluation of the site that included soil, groundwater, and soil gas sampling and analysis. Results of several field investigations prompted RIDEM to identify five AOCs. The objective of this SI was to address data gaps in two of the AOCs (AOCs #1 and #2), thereby completing the understanding of the areal and vertical extent of contamination at these AOCs.

HLA conducted the SI field investigation in accordance with the Sampling and Analysis Plan (SAP), issued October 1999 by HLA (HLA, 1999a). Field activities included a visual site inspection, the advancement of seven soil borings, installation and development of four new monitoring wells, redevelopment of three existing monitoring wells, and soil and groundwater sampling and analyses. Section 3.0 summarizes the SI field program, and Section 4.0 summarizes the analytical results of the sampling program. Section 5.0 presents the conclusions of the site characterization, and evaluation and recommendation of remedial alternatives for AOCs #1 and #2.

### **2.2 PROJECT OBJECTIVES**

The objectives of this investigation were to perform soil and groundwater sampling and analysis at the site of the former mill where supplemental data are necessary to bridge the data gaps and determine the horizontal and vertical extent of contamination at AOCs #1 and #2. Analytical results of soil sampling were compared to R-DEC and I/C-DEC and RIDEM GBLC. Groundwater analytical results were compared to RIDEM GB Groundwater Objectives. These criteria are provided in Appendix A. Note that the comparison of analytical data to RIDEM criteria does not constitute the performance of a risk characterization for the site. Rather, the criteria were used as a screening tool to allow for an evaluation of the magnitude of the contamination at AOCs #1 and #2.

The ultimate goals for this property are to address contamination identified at each of the AOCs, clear surface debris and other physical hazards from the site, and redevelop the property as an USEPA Brownfields Showcase Community model (USEPA, 1998). Rhode Island plans to use the Showcase Communities project to revitalize the distressed nature of the site and restore it to beneficial use. Plans include creation of a greenway along the river and a parcel for commercial and/or light industrial development.

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## SECTION 2

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### 2.3 SITE LOCATION

The Former Riverside Mills Brownfields Site (Figure 1-2) occupies six acres of land located at 50 Aleppo Street, in the Olneyville section of Providence, Rhode Island. The area surrounding the site is characterized by multi-family homes, small businesses, and the Atlantic Mills complex (a former mill complex that is currently occupied by several small businesses). The Woonasquatucket River is located at the southern and eastern boundary of the property. Downstream of the site, the Woonasquatucket River joins the Providence River and ultimately drains into Narragansett Bay. Based on bedrock geologic maps, the site is located near the contact between the Blackstone Group (Pre-Cambrian in age) and Narragansett Basin rocks (Pennsylvanian) (RIDEM, 1997).

### 2.4 OWNERSHIP AND PRIOR LAND USE

The mill was constructed in 1863 by the Champlin and Downes Company, and was used to manufacture textiles for the garment industry. The mill was reincorporated in 1873 as the Riverside Worsted Mills, and employed up to 2,700 workers. Mill operations continued until 1937. During subsequent decades, the former mill complex (a four-story structure) housed several tenants employed in smaller-scale, industrial operations. Such operations included manufacturing, metal plating, polishing, distributing, machining, casting, and soldering (RIDEM, 1997).

On December 18, 1989, a fire destroyed the mill complex. Most of the structure was demolished, leaving piles of bricks, granite blocks, and other building demolition debris strewn across the site. Concrete slab-on-grade foundations mark the footprint of the former mill, although thick vegetation (including weeds and small trees) has taken root within the former structure. Only one building, a two-story office building, remains standing. This structure is currently vacant, and has been vandalized over the past decade. The property is apparently used as an informal dumping ground for household and commercial waste.

### 2.5 SUMMARY OF PAST WORK

Information presented in this section was provided in the RIDEM *Remedial Evaluation Report, Former Riverside Mills Site, Providence, Rhode Island* (August 1997) and the USACE-NAE *Statement of Work* (July 20, 1999, revised August 19, 1999).

On December 19, 1989, the day after the fire that destroyed the mill complex, RIDEM conducted an inspection of the site to determine whether fire-fighting activities had affected the river. RIDEM discovered that hazardous materials had been stored at the site. Subsequent inspections led to the discoveries of several drums containing waste oil, soil fumigants, and waste TCE, as well as bags of asbestos. On April 5, 1990, RIDEM issued a Notice of Violation and Order (ERB No. 90-08) to the property owner for hazardous waste storage/disposal violations.

As part of the Brownfields Pilot Project, RIDEM conducted a Remedial Evaluation of the former Riverside Mills property that included two field investigations: one conducted in October 1996, and one in April 1997. Field activities included geophysical surveys using ground-penetrating radar, installation and sampling of monitoring wells and soil borings, excavation of test pits, and the collection of surface soil samples and soil gas samples. Investigation locations are shown on Figure 2-1. Over the course of these investigations, four underground storage tanks (USTs) and an underground concrete vault were

discovered at the site. The four USTs contained approximately 28,000 gallons of No. 6 fuel oil, and the concrete vault contained up to 90,000 gallons of a liquid tentatively identified as a combination of diesel fuel and motor oil.

Following completion of the 1996 and 1997 site investigations, RIDEM identified the following AOCs at the Former Riverside Mills Brownfields Site:

Area of Concern (AOC)	Contamination Description	Location
AOC #1	Plume of lighter-than-water, non-aqueous phase liquid (LNAPL) on groundwater	Eastern end of the site
AOC #2	TPH in soil, and VOCs in groundwater	Eastern boundary of the site
AOC #3A & 3B	USTs and underground concrete vault	Two USTs under gravel drive, two USTs and concrete vault near paved parking area
AOC #4	TPH in soil	Southwestern boundary of the site
AOC #5	Widespread demolition debris and bulky waste	Site-wide

Figure 2-1 shows the location of each AOC.



### 3.0 SITE INVESTIGATION

This SI was undertaken to address contamination at AOC #1, which is characterized by LNAPL on groundwater, and AOC #2, characterized by TPH in soil and VOCs in groundwater. A visual site inspection was performed on September 20, 1999, and subsequent field activities were conducted between November 8 and 19, 1999.

#### 3.1 INTRODUCTION

The SI field program conducted at the Former Riverside Mills Brownfields Site included the following activities:

<u>Activity</u>	<u>Rationale</u>
Drilling and Soil Sampling	To delineate the horizontal extent of contamination at AOC #1, the horizontal and vertical extent of soil contamination at AOC #2, and to determine the soil profile to bedrock or to 50 feet below ground surface, whichever is encountered first.
Monitoring Well Installation and Groundwater Sampling	To collect groundwater samples from three existing monitoring wells and four new monitoring wells, in order to obtain additional groundwater data.

Activities conducted during the SI field program included:

- completion of a visual site inspection and field verification (site walkover),
- drilling seven soil borings,
- collecting subsurface soil samples and grab groundwater samples at selected boring locations,
- installation and development of four new monitoring wells,
- redevelopment of three existing monitoring wells, and
- groundwater sampling of the three existing and four new monitoring wells.

During the field program, HLA obtained representative samples of soil and groundwater for chemical analyses. Soil and groundwater samples were analyzed for VOCs, SVOCs, and TPH. Analytical results were used for the following purposes:

- to assess the extent of TPH contamination at AOC #1, and
- to assess the extent of VOC contamination at AOC #2.

SI field procedures were performed in conformance with the *Statement of Work* (USACE-NAE, 1999), the SAP (HLA, 1999a), and the *Site Safety and Health Plan* (SSHP) (HLA, 1999b). Sampling locations are shown on Figure 3-1, and details of the field investigation are provided in the following subsections.

## SECTION 3

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### 3.2 VISUAL SITE INSPECTION AND FIELD VERIFICATION

On September 20, 1999, prior to initiating the SI field investigation, HLA conducted a site walkover at the Former Riverside Mills Brownfields Site. At that time, HLA personnel met with land surveyors from Fuss & O'Neill, who were contracted by USACE-NAE to perform a comprehensive topographic survey of the property. Proposed drilling and monitoring well locations were selected, and were subsequently tied into the survey. Observations made during the visual site inspection were used to refine the sampling and analytical program, and to determine appropriate health and safety considerations, prior to issuing the SAP and the SSHP (HLA, 1999a and 1999b).

### 3.3 SOIL BORINGS

As stated in the USACE-NAE *Statement of Work*, the objectives of the soil drilling and sampling program were to:

- determine the stratigraphy of the soil overburden;
- classify the bedrock underlying the site, if encountered within 50 feet of the ground surface;
- determine the horizontal extent of TPH contamination in soil at AOC #1; and
- determine the horizontal and vertical extent of VOC contamination in soil at AOC #2.

HLA subcontracted GeoLogic, Inc., of Hopkinton, Massachusetts, to provide drilling and well installation services. Extensive brush clearance was necessary because of the thick vegetation that covers the property, and a drill rig mounted on an all-terrain vehicle was used to access the proposed drilling locations.

A total of seven soil borings were advanced at the site. Three of the borings (SB99-1 through SB99-3) were drilled at AOC #2, in the vicinity of existing well MW-2, and the remaining four borings (SB99-4 through SB99-7) were located near the perimeter of the LNAPL plume at AOC #1 (see Figure 3-1). Hollow-stem augers (HSAs) with an inside diameter (ID) of 4.25 inches were used to drill all but one of the borings. At SB99-1, drive and wash drilling techniques with 4 inch (ID) casing were used in anticipation of rock coring at that location. To minimize the potential for cross-contamination, the augers, rods, casing, rollerbits, and any other equipment used during drilling were steam-cleaned at a decontamination pad constructed by the drilling contractor following completion of each boring.

Soil borings SB99-2 and SB99-4 through SB99-7 were drilled to a total depth of 20 feet bgs. Soil boring SB99-1 extended to a depth of 56 feet bgs, in an attempt to locate the bedrock surface; however, bedrock was not observed or cored. At boring SB99-3, running sands were encountered that prevented advancement past a depth of 16 feet bgs. It was necessary to introduce a minimal amount of water at this location (approximately 40 gallons) into the center of the augers, in order to keep the running sands from clogging drilling equipment. Running sands were not encountered in any other borehole.

Split-spoon soil samples were collected at continuous two-foot intervals within each boring, in accordance with American Society for Testing and Materials (ASTM) Standard Practice D 1586-67. The HLA field geologist logged the soil samples during drilling, noting the stratigraphy and the depth to groundwater at each location. Each split-spoon sample was characterized using the Unified Soil Classification System (USCS), and was screened in the field for total VOCs in soil jar headspace using a photoionization detector (PID).

Observations made during the drilling program include the following:

- At deep boring location SB99-1, obvious evidence of contamination (e.g., odors, staining, or elevated VOC headspace measurements) was not observed below 10 feet bgs. This boring extended to a depth of 56 feet bgs, and bedrock was not encountered. Soil observed consists of poorly graded medium sand with minor variations to fine and silty sand with depth.
- The 8- to 10-foot bgs soil sample collected at SB99-2 exhibited a slight sheen and a strong odor. This depth interval also corresponded with the highest VOC headspace measurement at this location, 396 ppm. Below 12 feet bgs, total VOCs in headspace dropped significantly. Groundwater at this location was observed at a depth of approximately 7 feet bgs.
- No odors or staining were noted in samples from SB99-3, although measurements of total VOCs in headspace were up to 295 ppm (7 to 9 feet bgs).
- An oil-like material accompanied by a strong fuel-like odor was observed at SB99-4, at a depth of 10 feet bgs. This depth corresponds to the observed water table. Total VOCs in headspace of the 8- to 10-foot sample were 412 ppm.
- At SB99-5, a strong fuel like odor was noted in the 4- to 6-foot sample.
- Obvious contamination was not observed at locations SB99-6 and SB99-7.

Figure 3-3 is a geologic cross section of the property; its orientation is shown in plan view on Figure 3-2. Additional soil description is provided in the Soil Boring Logs, which are provided in Appendix B.

### **3.4 MONITORING WELL INSTALLATION**

Groundwater monitoring wells were installed in four of the seven boreholes following completion of the soil boring. The remaining three soil borings were backfilled to the ground surface using soil cuttings. Each monitoring well was installed such that its ten-foot screen spans across the water table, which was encountered at depths ranging from 6 to 9 feet bgs. MW99-5 was constructed in the SB99-3 borehole, to determine the extent of VOCs in groundwater at AOC #2. The three remaining wells, MW99-6 through MW99-8, were installed in borings SB99-4 through SB99-6, respectively, to evaluate the extent of TPH at AOC #1. Soil boring/monitoring well locations are shown on Figure 3-1.

#### **3.4.1 Monitoring Well Construction**

Well installation details were recorded on Monitoring Well Construction Diagrams (see Appendix C). Each well is constructed of 2-inch ID, Schedule 40 PVC screen and riser. The screens are 10 feet in length, and are factory-slotted with a slot width of 0.010 inch such that the screen retains at least 90 percent of the filter pack material. A bottom cap was installed on each well. Each screen is attached to 2-inch diameter, Schedule 40 PVC riser pipe. All joints were threaded, and no PVC solvent was used. The well riser was equipped with a locking, vented cap.

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The annulus between each well screen and borehole wall was backfilled with a No. 1-size, silica-based sand, creating a filter pack around the screen. In each well, the filter pack extends 2 feet above the top of the screen. A 3-foot thick bentonite chip seal was placed directly above the sand pack. Each well was completed at the ground surface with a flush-mounted protective casing sealed with cement.

### 3.4.2 Monitoring Well Development / Redevelopment

To reduce the amount of fine-grained material in and around the filter pack, the four newly installed monitoring wells (MW99-5 through MW99-8) and three existing monitoring wells (MW-1 through MW-3) were developed using standard pump-and-surge techniques. Well development/redevelopment was performed on November 16 and 17, 1999. Well water was evacuated with a dedicated submersible pump. No water, acids, dispersing agents, or explosives were introduced into any well during development. At well MW99-5, a volume of water equivalent to the volume of drilling water that was introduced into the geologic formation during well installation (40 gallons) was purged from the well during development.

Wells were developed until pH, specific conductance, temperature, and turbidity measurements were stable and the well water was as clear to the unaided eye as possible. The pH was considered to be stable when there was less than a 0.2 pH unit of change between three consecutive measurements. Similarly, temperature was considered stable when three consecutive readings were within plus or minus ½ of one degree Celsius. For specific conductance, stabilization was considered to be less than a 10 percent change between two consecutive readings. Turbidity was considered stable when the percent change in value between two consecutive readings was 15 percent or less.

Because groundwater from wells MW99-5 and MW99-6 showed evidence of possible contamination, the water purged from these wells during development was transferred to U.S. Department of Transportation (DOT)-approved, 55-gallon drums for ultimate disposal at an off-site facility. Details of well development were recorded on Well Development Records, which are included in Appendix D.

### 3.5 SAMPLING PROGRAM

To determine the extent of contamination at AOCs #1 and #2, and to determine the potential for transport of contaminants to the Woonasquatucket River, soil and groundwater samples were collected and analyzed for TPH, VOCs, and SVOCs, using SW-846 Methods (USEPA, 1996b). This section presents a summary of the sampling program. Analytical results are presented in Subsections 4.3 and 4.4.

HLA subcontracted AMRO Environmental Laboratories Corporation (AMRO) of Merrimack, New Hampshire, to provide chemical analytical services for this project. AMRO has been validated by the USACE Missouri River Division. In addition, quality assurance (QA) replicate samples were submitted to a laboratory contracted directly by USACE. The designated QA laboratory for this project is Severn Trent Laboratories (STL). Note that analytical results of QA replicate sampling are not presented in this report.

Samples collected during the SI field program were identified using a 12-digit numbering system, as described below:

Digits 1 & 2	<u>Site Designation</u> RM – Riverside Mills
Digits 3 & 4	<u>Sample Type</u> BS – Soil boring soil sample BW – Soil boring grab groundwater sample GW – Monitoring well groundwater sample (low flow sample) QT – Trip blank QS – Rinsate blank
Digits 5, 6	<u>Horizontal Sample Locator</u> – indicates the exploration location number (e.g., 02, 03).
Digits 7, 8	<u>Vertical Sample Locator</u> – indicates the <i>top</i> of the sample depth interval. For example, a soil sample collected from 4 to 6 feet bgs would be given the designation “04”, and a grab groundwater sample collected at a depth of 12 feet bgs would be designated “12”. In the case of low flow groundwater samples, these two characters are designated “XX” as a place holder.
Digits 9, 10	Used as <u>sampling event</u> numbers when more than one round of sampling is required. For example:  01 – indicates Round 1 02 – indicates Round 2
Digits 11, 12	<u>Modifiers</u> XX – Regular field sample XR – Replicate sample (to QA laboratory) XS – Matrix Spike XM – Matrix Spike Duplicate

For example, a groundwater sample collected from monitoring well MW99-5 during sampling round one would have an identification number of:

RMGW05XX01XX

Subsections 3.5.1 and 3.5.2, below, summarize the soil and groundwater sampling programs.

### **3.5.1 Soil Sampling Program**

From the seven soil borings that were installed at AOCs #1 and #2 (SB99-1 through SB99-7), a total of eight soil samples (including two samples from SB99-1) were submitted to the contract laboratory for analysis of TPH (using modified USEPA Method 8015B), VOCs (using USEPA Method 8260B-high level, with preparation method 5035), and SVOCs (using USEPA Method 3540C/8270C). The previous analyses for TPH were conducted using USEPA Method 418.1; however, HLA used the more current analytical method, modified USEPA Method 8015B, resulting in measurements of DRO and GRO.

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When added together, the total concentration equates to the TPH measurement for the representative soil sample. This analytical result is not readily comparable to Method 418.1 TPH. Many non-petroleum hydrocarbons respond on the infrared detection system used in Method 418.1. Studies have shown that it is possible to get positive interference from natural hydrocarbons including humic acids found in soil and sediment with high organic content and decaying plant material. The Method 418.1 TPH procedure is generally considered to provide qualitative measurements with lower accuracy and dependability (Schwerko, 1993). In 1996, the USEPA included petroleum hydrocarbon procedures in USEPA Method 8015B using gas chromatography with a flame ionization detector. In general, modified USEPA Method 8015B is expected to produce the more reliable data on the presence and concentrations of petroleum hydrocarbons.

In addition to the soil sampling program described above, one soil sample was submitted to the QA laboratory for analysis of TPH, VOCs, and SVOCs. To determine which depth intervals were to be sampled for off-site analyses, split spoon soil samples were screened for total VOCs in soil jar headspace using a PID. At each location, samples from the depth intervals with the highest headspace screening result were selected for off-site chemical analysis.

Blind duplicate samples were collected at a frequency of one per every 10 field samples, and matrix spike/matrix spike duplicate (MS/MSD) samples were collected at a frequency of one per every 20 field samples. Each shipment of soil samples to each laboratory was accompanied by a trip blank that was analyzed for VOCs. An equipment rinsate blank was also collected for VOCs and SVOCs analyses.

As shown in the table below, a total of 36 soil samples were shipped to the contract laboratory (AMRO) for analysis:

**Summary of Contract Laboratory Soil Samples**

Analysis	No. of Samples	No. of Duplicates	MS/MSD	Rinsate	Trip Blanks	TOTAL NO. OF SAMPLES
TCL VOCs	8	1	1/1	1 (aqueous)	1 *	13
TCL SVOCs	8	1	1/1	1 (aqueous)	0	12
TPH	8	1	1/1	0	0	11

**Total: 36**

- Trip blanks are pre-preserved sample vials (with methanol) that travel from the lab to the field and back to the lab along with volatile soil samples. One shipment of soil samples was sent to AMRO.

QA replicate soil samples were collected at a frequency of one for every 10 field samples. A total of four soil samples was submitted to the USACE-NAE designated QA laboratory (STL), as shown in the table below:

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### Summary of Quality Assurance Laboratory Soil Samples

Analysis	No. of Replicates	Rinsate	Trip Blanks	TOTAL NO. OF SAMPLES
TCL VOCs	1	0	1 *	2
TCL SVOCs	1	0	0	1
TPH	1	0	0	1

Total: 4

\* Trip blanks are pre-preserved sample vials (with methanol) that travel from the lab to the field and back to the lab along with volatile soil samples. One shipment of soil samples was sent to STL.

### 3.5.2 Groundwater Sampling Program

Two types of groundwater samples were obtained during the SI field program:

- Grab groundwater samples were collected directly from two of the soil borings (SB99-1 and SB99-2), and
- Low flow groundwater samples were collected from each of the four new monitoring wells (MW99-5 through MW99-8) as well as three existing monitoring wells (MW-1 through MW-3).

#### 3.5.2.1 Water Level Measurement

Prior to collecting low flow samples, a round of groundwater level measurements was conducted to allow for a determination of the local groundwater flow direction. Measurements were made at the four newly installed wells (MW99-5 through MW99-8) and the three existing wells (MW-1 through MW-3), using an electronic water level meter capable of accurate readings to the nearest 0.01 foot. Water level data were recorded on a water level data sheet, which is included in Appendix E, and groundwater elevations are summarized on Table 3-1. Groundwater elevations ranged from 85.18 feet at MW-1 to 87.46 feet at MW99-8. Groundwater elevations are referenced to an established local datum, and are not corrected to the National Geodetic Vertical Datum (NGVD). The horizontal datum is referenced to the North American Datum of 1983, and the vertical datum is referenced to the North American Vertical Datum of 1929 (NAVD 29). The vertical adjustment to NAVD was -61.43. Note that this information was not available at the time when the site plan was being prepared. As shown on Figure 4-5, shallow groundwater below this portion of the site generally flows southeastward.

#### 3.5.2.2 Groundwater Sampling Methods

Two methods were used to collect groundwater samples during the field investigation. Grab groundwater samples were collected directly from soil borings SB99-1 and SB99-2, and low flow groundwater samples were collected from each of the four new monitoring wells (MW99-5 through MW99-8) and three existing wells (MW-1 through MW-3).

Grab groundwater samples were collected using a Teflon® bailer lowered within the auger flights.

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Groundwater samples obtained from monitoring wells were collected using the *USEPA Region I Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (USEPA, July 30, 1996a). All wells were purged and sampled using dedicated Whale-brand submersible pumps attached to polyethylene tubing. Depending on field observations of groundwater quality, the water was either discharged to the ground surface or transferred to DOT-approved, 55-gallon drums for ultimate disposal at an off-site facility.

At each well, the pump intake was set at the midpoint of the saturated screen length (at least 2 feet above the bottom of the well). To minimize the entrainment of suspended solids into the groundwater sample, the flow rate was restricted to between 0.2 and 0.5 liters per minute. Evacuated purge water was periodically monitored for temperature, pH, dissolved oxygen, oxidation-reduction potential, turbidity, and specific conductance. Purging of the standing well water was considered complete when the rate of drawdown had stabilized, all water parameters were stable, and (ideally) the turbidity of the purgewater was below 5 nephelometric turbidity units (NTUs). Additional procedural details are provided in the SAP (HLA, 1999a). Groundwater sampling data were recorded on Low Flow Groundwater Sampling Forms, which are provided in Appendix F.

### 3.5.2.3 Groundwater Analytical Program

A total of 9 groundwater samples (including the grab samples and the low flow samples) was submitted to AMRO for analysis of TPH (using modified USEPA Method 8015B), VOCs (using Method 8260B, with preparation by Method 5030B), and SVOCs (USEPA Method 3520C/8270C). In addition, one low flow groundwater sample was submitted to STL (QA laboratory) for analysis of TPH, VOCs, and SVOCs.

QA and Quality Control (QC) samples collected during the groundwater sampling program include duplicate, MS/MSD, and trip blank samples. Because dedicated submersible pumps were used at each well, no equipment rinsate blank samples were collected. Blind duplicate samples were collected at a frequency of one per every 10 field samples, and MS/MSD samples were collected at a frequency of one per every 20 field samples. Each shipment of groundwater samples to each laboratory was accompanied by a trip blank that was analyzed for VOCs.

As shown in the table below, a total of 40 groundwater samples was shipped to AMRO for analysis.

**Summary of Contract Laboratory Groundwater Samples**

Analysis	No. of Samples	No. of Duplicates	MS/MSD	Rinsate	Trip Blanks	TOTAL NO. OF SAMPLES
TCL VOCs	9	1	1/1	0	4 *	16
TCL SVOCs	9	1	1/1	0	0	12
TPH	9	1	1/1	0	0	12

Total: 40

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\* Trip blanks are pre-preserved sample vials (with hydrochloric acid, filled with water) that travel from the lab to the field and back to the lab along with volatile groundwater samples. Four shipments of groundwater samples were sent to AMRO.

QA replicate groundwater samples were collected at a frequency of one for every ten field samples, as shown in the table below. A total of four groundwater samples were submitted to the USACE-NAE designated QA laboratory (STL), as shown in the table below:

**Summary of Quality Assurance Laboratory Groundwater Samples**

Analysis	No. of Replicates	Rinsate	Trip Blanks	TOTAL NO. OF SAMPLES
TCL VOCs	1	0	1 *	2
TCL SVOCs	1	0	0	1
TPH	1	0	0	1

**Total: 4**

\* Trip blanks are pre-preserved sample vials (with hydrochloric acid, filled with water) that travel from the lab to the field and back to the lab along with volatile groundwater samples. One shipment of groundwater samples was sent to STL.

## 4.0 ANALYTICAL RESULTS

This section summarizes analytical results of soil and groundwater samples collected during the SI field program.

### 4.1 INTRODUCTION

The objectives of the SI sampling and analytical program were to determine the horizontal and vertical extent of contamination at AOCs #1 and #2, and to determine whether site-related contaminants are potentially affecting the Woonasquatucket River. Soil analytical results are compared to R-DEC and I/C-DEC and RIDEM GBLC. Groundwater analytical results are compared to RIDEM GB Groundwater Objectives. These criteria are provided in Appendix A.

### 4.2 SUMMARY OF DATA VALIDATION

Analytical data obtained from the contract laboratory (AMRO) was organized into a working set and validated by HLA's project chemist. Data validation was completed in accordance with procedures described in the SAP (HLA, 1999a), and validation actions were based on USEPA Region I validation guidelines (USEPA, 1996c). The complete data validation report is provided in Appendix G.

During the data review, analytical data summaries provided by the laboratory were evaluated including method blank results, laboratory control samples recovery, matrix spike/matrix spike duplicates (MS/MSDs) recovery, surrogate recovery, and trip blanks. No field duplicates were submitted for analysis. Evaluation of the raw data and transcription checks from raw data to reporting forms were not included in the review. The majority of the results were determined to be usable without qualification, and in general, data quality is interpreted to meet the data quality goals for the project. A subset of results has been qualified during validation.

Review of the analytical data included a complete transcription check of the hardcopy results versus the electronic deliverable results. No errors or omissions were found during the electronic deliverable review.

### 4.3 SOIL

Each soil sample was analyzed for VOCs, SVOCs, and TPH. Analytes detected in soil are summarized in Table 4-1 and on Figures 4-1 through 4-3. Summary tables of all soil data are provided in Appendix H. The complete laboratory reports were provided to USACE-NAE under separate cover.

AOC #1. Only one VOC was detected in one AOC #1 soil sample. Cis-DCE was detected at SB99-6 (8 to 10 feet bgs) at a concentration of 54 micrograms per kilogram ( $\mu\text{g/kg}$ ), which is well below the applicable R-DEC (630,000  $\mu\text{g/kg}$ ), I/C-DEC (10,000,000  $\mu\text{g/kg}$ ), and GBLC (60,000  $\mu\text{g/kg}$ ).

Only one AOC #1 soil sample contained SVOCs: the duplicate sample collected at SB99-4 (8 to 10 feet bgs). At this location, low concentrations of benzo(a)anthracene (0.27 mg/kg), benzo(g,h,i)perylene (0.28 mg/kg) and chrysene (0.39 mg/kg) were detected, concentrations which are all below R-DECs, I/C-DECs, and GBLCs.

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SB99-5 (both 8 to 10 feet bgs) at concentrations of 1,000 mg/kg and 1,700 mg/kg, respectively, exceeding the Method 1 Residential TPH Direct Exposure Criterion of 500 mg/kg. These samples also contained GRO at concentrations of 9.2 mg/kg (SB99-4, 8 to 10 feet bgs) and 3.5 mg/kg (SB99-5, 8 to 10 feet bgs). A soil sample collected at SB99-6 did not contain TPH.

It should be noted that the 1999 TPH analytical results are not directly comparable to the 1996/1997 TPH results due to the different analytical methods used (Subsection 3.5.1) and the concentration of TPH at AOC #1 will have likely decreased due to natural attenuation occurring at the site.

### Summary of Analytes Exceeding RIDEM Soil Criterion November 1999

Parameter	RIDEM Direct Exposure Criteria		RIDEM GB Leachability Criteria	SB99-2 (8-10') RMBS0208 XXXX	SB99-3 (7-9') RMBS0307 XXXX	SB99-4 (8-10') RMBS0408 XXXX (Duplicate)	SB99-5 (8-10') RMBS0508 XXXX
	Residential	Industrial/Commercial					
Benzo(a)Anthracene	0.9	7.8	—	1.1	3.7	NE	NE
Benzo(a)Pyrene	0.4	0.8	—	1	2.9	NE	NE
Benzo(b)Fluoranthene	0.9	7.8	—	1.2	3.6	NE	NE
Benzo(g,h,i)Perylene	0.8	10,000	—	NE	1.6	NE	NE
Benzo(k)Fluoranthene	0.9	78	—	NE	1.1	NE	NE
Chrysene	0.4	780	—	0.95	3.4	NE	NE
Dibenzo(a,h)Anthracene	0.4	0.8	—	NE	0.54	NE	NE
Indeno(1,2,3-c,d)Pyrene	0.9	7.8	—	NE	1.8	NE	NE
Diesel Range Organics (DRO)	500	2500	2500	730	NE	1000	1700

NE = indicates that the detected concentration did not exceed one or more RIDEM criterion.

**AOC #2.** Three VOCs were detected in AOC #2 soil samples, but all at concentrations R-DEC and I/C-DEC and RIDEM GBLC. Cis-DCE was detected at SB99-3 (790 µg/kg, 7 to 9 feet bgs) and SB99-7 (1,300 µg/kg, 8 to 10 feet bgs). PCE was detected in only one sample, at a concentration of 91 µg/kg (SB99-3, 7 to 9 feet bgs). TCE was detected in four samples, at concentrations ranging from 170 µg/kg (SB99-2, 8 to 10 feet bgs) to 6,700 µg/kg (SB99-3, 7 to 9 feet bgs). No other VOCs were detected in soil samples.

Several SVOCs (primarily PAHs) were detected in soil samples, although only two of the samples had SVOC concentrations which exceed RIDEM Direct Exposure Criteria: the 8- to 10-foot sample from SB99-2, and the 7- to 9-foot sample from SB99-3. Samples from these two locations contained the following SVOCs at concentrations above R-DECs: benzo(a) anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(g,h,i)perylene, benzo(k)fluoranthene, chrysene, dibenz(a,h)anthracene, and indeno(1,2,3-cd)pyrene. Of the detected SVOCs, only benzo(a)pyrene was at concentrations which exceed its I/C-DEC of 0.8 mg/kg: 1 mg/kg at SB99-2, and 2.9 mg/kg at SB99-3. No SVOCs were detected at SB99-1 or SB99-7.

TPH was detected at all but one AOC #2 location: SB99-7. GRO were detected in one sample, SB99-2

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TPH was detected at all but one AOC #2 location: SB99-7. GRO were detected in one sample, SB99-2 (8 to 10 feet bgs), at a concentration of 130 mg/kg. DRO were detected in four samples, at concentrations ranging from 84 mg/kg (SB99-1, 4 to 6 feet bgs) to 730 mg/kg (SB99-2, 8 to 10 feet bgs) exceeding the Method 1 Residential TPH Direct Exposure Criterion of 500 mg/kg.

#### 4.4 GROUNDWATER

Grab groundwater samples were collected from borings SB99-1 and SB99-2, and low flow groundwater samples were collected from existing monitoring wells MW-1 through MW-3 and new monitoring wells MW99-5 through MW99-8. Each groundwater sample was analyzed for VOCs, SVOCs, and TPH. Analytes detected in groundwater are summarized in Table 4-2, and VOCs detected in groundwater are shown on Figure 4-4. Summary tables of all groundwater data are provided in Appendix H. The complete laboratory reports were provided to USACE-NAE under separate cover.

**AOC #1.** TPH and SVOCs were not detected in any of the three groundwater samples collected at AOC #1. Relatively low concentrations of VOCs (i.e., at concentrations well below applicable criteria) were detected in each sample.

**AOC #2.** TPH was detected in only one groundwater sample collected at AOC #2. The grab sample from SB99-2 contained DRO at a concentration of 4 J mg/L and GRO at a concentration of 0.59 mg/L. As discussed in Subsection 3.5.1, the 1999 TPH analytical results are not directly comparable to the 1996/1997 TPH results. This is due to the different analytical methods used (USEPA Method 418.1 versus modified USEPA Method 8015B, respectively) and the natural attenuation occurring at the site decreasing the concentration of TPH.

Similarly, only one sample contained SVOCs: the SB99-2 grab sample. Most of the detected SVOCs were PAHs, including benzo(a)anthracene (20 micrograms per liter [ $\mu\text{g/L}$ ]), benzo(a)pyrene (16  $\mu\text{g/L}$ ), benzo(b)fluoranthene (25  $\mu\text{g/L}$ ), benzo(g,h,i)perylene (15  $\mu\text{g/L}$ ), chrysene (20  $\mu\text{g/L}$ ), fluoranthene (42  $\mu\text{g/L}$ ), indeno(1,2,3-cd)pyrene (16  $\mu\text{g/L}$ ), and pyrene (42  $\mu\text{g/L}$ ). SVOCs were not detected in any other groundwater sample.

**Summary of Analytes Exceeding RIDEM Groundwater Criterion  
November 1999**

Parameter	RIDEM Method 1 GB Groundwater Objective	MW99-5 RMGW05XX01XX	RMGW09XX01XX (blind duplicate of RMGW05XX01XX)
1,1-Dichloroethene	7	7.6 J	9.5
1,2-Dichloroethene (cis)	2,400	13000	13000
Trichloroethene	540	10000	11000

VOCs, primarily chlorinated ethenes, were detected in every groundwater sample, although only one sample (and its duplicate) contained VOCs at concentrations that exceed RIDEM GB groundwater objectives: MW99-5. This low flow sample and duplicate sample contained 1,1-DCE at concentrations

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of 7.6 J  $\mu\text{g/L}$  and 9.5  $\mu\text{g/L}$ , respectively, both above the Method 1 GB groundwater objective of 7  $\mu\text{g/L}$ . Cis-DCE concentrations in the MW99-5 sample and its duplicate were both 13,000  $\mu\text{g/L}$ , above the GB groundwater objective of 2,400  $\mu\text{g/L}$ . Similarly, the concentrations of TCE in this sample (10,000  $\mu\text{g/L}$ ) and its duplicate (11,000  $\mu\text{g/L}$ ) exceeded the GB groundwater objective of 540  $\mu\text{g/L}$ .

Based on water level measurements made prior to sampling, groundwater below the eastern portion of the site flows southeastward, toward the Woonasquatucket River (see Figure 4-5). The water table is present at a depth between 6 feet and 9 feet bgs. Given the detections of analytes in groundwater, the shallow groundwater depth, and the proximity of the monitoring wells to the river, the potential exists for site-related contaminants to migrate to the river.

### 4.5 INVESTIGATION DERIVED WASTE

As a result of the completion of SI field activities, solid and liquid investigation-derived waste (IDW) has been generated in association with decontamination, screening sample preparation and handling, drilling, and groundwater purging activities. Every effort was taken to minimize the amount of IDW generated. Each material type (i.e., soil, groundwater) was drummed separately. Waste screening procedures are detailed in the SAP (HLA, 1999a).

Where feasible, soil cuttings generated during the drilling program were returned to their original boreholes. Any soil cuttings that could not be returned to the boreholes were transferred to DOT-approved, 55-gallon drums for ultimate off-site disposal. Decontamination fluids were also containerized in 55-gallon drums. At each monitoring well, samples of purge water and development water were screened for total VOCs in soil jar headspace using a PID. Headspace measurements for all but two of the wells (MW99-5 and MW99-6) were below the screening criterion of 10 ppm; therefore, the water was released to the ground surface, away from the wells. Development water and purge water from MW99-5 and MW99-6 was transferred to 55-gallon drums.

Following completion of the SI field program, there are a total of three drums of soil cuttings and two drums of liquid temporarily staged at the site, pending characterization prior to removal.

## 5.0 CONCLUSIONS AND RECOMMENDATIONS

Subsection 5.1, below, presents a comparison of analytical results of the 1999 SI sampling program to results of the 1996-1997 Remedial Evaluation. A preliminary evaluation of proposed remedial alternatives for the site is presented in Subsection 5.2.

### 5.1 COMPARISON OF SI ANALYTICAL RESULTS TO 1996-1997 REMEDIAL EVALUATION RESULTS

#### *Soil*

None of the VOCs detected in subsurface soil samples collected during either the 1996-1997 Remedial Evaluation or the 1999 SI exceeded R-DEC and I/C-DEC or RIDEM GBLC. The highest VOC concentrations were detected at 1997 test pits TP-19 at 9 to 10 feet bgs (benzene, toluene, ethylbenzene, and xylenes [BTEX] = 1037 µg/kg, TCE = 55 µg/kg, and cis-DCE = 102 µg/kg) and TP-20 at 0 to 2 feet bgs (TCE = 833 µg/kg, cis-DCE = 27 µg/kg); and 1999 soil borings SB99-3 at 7 to 9 feet bgs (TCE = 6700 µg/kg, cis-DCE = 790 µg/kg) and SB99-7 at 8 to 10 feet bgs (TCE = 5900 µg/kg, cis-DCE = 1300 µg/kg). Except for TP-20, these depths correspond to the depth of the water table and probably indicate presence of the groundwater VOC plume at these locations.

During the Remedial Evaluation, TPH contamination was encountered in subsurface soil at AOCs #1 and #2. The maximum detected concentration was 14,770 mg/kg, at test pit TP-25 (10 feet bgs). While TPH was detected in 1999 SI soil samples, the concentrations were generally lower than those detected during the Remedial Evaluation. The maximum concentration detected in an SI soil sample was 1,700 mg/kg (TPH-DRO), at soil boring SB99-5, 8 to 10 feet bgs. This is in part due to the use of an analytical method that screens out interferences from naturally occurring organics and the natural attenuation of the TPH contaminants. The soil borings drilled during the SI, therefore, further delineate the extent of TPH contamination in soil.

#### *Groundwater*

The highest concentrations of VOCs in groundwater below the site have been detected in monitoring wells MW99-5 (PCE = 29 µg/L, TCE = 11,000 µg/L, cis-DCE = 13,000 µg/L, trans(1,2)-dichloroethene [trans-DCE] = 70 µg/L, 1,1-DCE = 9.5 µg/L, and VC = 36 µg/L), located along the boundary between AOC #1 and AOC #2 approximately 50 ft north of the Woonasquatucket River, and MW-2 (TCE = 2.8J µg/L, cis-DCE = 890 µg/L, trans-DCE = 2.5J µg/L, 1,1-DCE = 1.6J µg/L, and VC = 120J µg/L), which was installed within AOC #2 approximately 25 feet north of the River and 25 ft south-southwest of MW99-5. Because of the proximity of these wells to each other, and the fact that groundwater from both wells contained chlorinated ethenes, the VOCs detected in these wells are probably derived from a common source.

Three of the monitoring wells on site, MW-1, MW-2, and MW-3, have been sampled twice for VOCs: once during the Remedial Evaluation, and once during this SI. At MW-1 and MW-3, results of both rounds of sampling are comparable and concentrations are less than 10 µg/L for any constituent. However, at MW-2, the concentrations of VOCs dropped between the first round (1997) and the second round (1999). For example, the concentration of cis-DCE dropped from 7,700 µg/L in the 1997 sample

## SECTION 5

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to 890 mg/L in the 1999 sample. Similarly, the concentration of TCE dropped from approximately 340 µg/L (first round) to approximately 2.8 µg/L (second round).

The chlorinated ethenes present in all samples from both rounds of sampling do indicate that natural biodegradation has been occurring as significant levels of TCE degradation products, cis-DCE and VC, were detected. In the second round of samples the transformation is more complete (i.e., higher concentration of degradation products than parent compound), and the total ethene concentrations are lower indicating reduction of total mass of contaminant (i.e., total destruction of contaminant is occurring naturally). The relatively large reduction in chlorinated ethene concentration observed in MW-2 can be analyzed to calculate degradation half-lives of approximately 4.5 months for TCE and 11 months for cis-DCE. Although VC has increased slightly from 1997 (91 µg/L) to 1999 (120 µg/L), this is expected in the reductive dechlorination process and due to the overall apparent mass reduction observed, it is anticipated that the VC will also ultimately be degraded.

In the 1999 sampling episode, TPH was only detected in one groundwater sample (the grab sample from SB99-2), and at very low concentration (DRO = 4J mg/L, GRO = 0.59 mg/L). In 1997 TPH was detected at levels of approximately 100 mg/L in several groundwater samples.

The floating product plume identified in the 1997 Remedial Evaluation was not observed in any of the soil borings drilled at the perimeter of AOC #1 during the 1999 SI. The absence of NAPL at these locations could indicate that either (1) floating product apparently does not occur outside of the limits of the AOC, as identified in 1997, or (2) this plume has decreased in size by natural attenuation. The NAPL plume at AOC #1 is likely commingled with the area of VOCs in groundwater (AOC #2), and is a likely carbon source supporting anaerobic biodegradation of VOCs.

### 5.2 EVALUATION OF REMEDIAL ALTERNATIVES

As part of an USEPA Brownfields Showcase Community (Woonasquatucket River Greenway), this site will be part of an urban revitalization effort to restore greenspace and stimulate economic investment along the Woonasquatucket River. Specifically, the Woonasquatucket River Greenway Project will create a new 4.4-mile greenway and bike path along the Woonasquatucket River.

Remedial alternatives were developed in the RIDEM Remedial Evaluation Report for both AOC #1 and AOC #2. To develop remedial alternatives, several assumptions, as discussed in the Remedial Evaluation Report, were made, including:

- the uppermost two feet of contaminated soils at the site shall be remediated to RIDEM's R-DEC;
- contaminated soils below two feet at the site shall be remediated to RIDEM's I/C-DEC and the majority of the site will be encapsulated in some manner to prevent direct exposure to any remaining contaminated soils;
- due to the GB groundwater classification of the site, soils above the groundwater table shall be remediated to RIDEM's GBLC; and
- an ELUR shall be placed on the property to ensure that this property is not subsequently developed into residential property without addressing soil contamination issues.



For AOC #1, RIDEM recorded the presence of an LNAPL plume measuring 80 feet by 200 feet. The location of this plume, as shown on the RIDEM figure, is approximate only, as the figure is not to scale and shows only approximate sample locations. Since the plume was not encountered during the 1999 SI, it is believed that the plume is within the boundaries of the 1999 surveyed soil boring locations, although its exact horizontal extent is not known. If the existence of the separate phase oil plume is confirmed by future investigations, its removal according to the remedial alternatives suggested in the Remedial Evaluation Report should be assessed.

Three remedial alternatives were evaluated to address AOC #1, as presented in the 1997 Remedial Evaluation Report. These alternatives included:

- Excavation of Separate-Phase Oil and associated Contaminated Soil at Water Table
- Separate-Phase Oil Recovery (Total Fluids Pumps), and
- Separate-Phase Oil Recovery (Trenches using Product Only Pumps)

The remedial alternative selected by RIDEM was the excavation of contaminated soils. Although this was more expensive than the two in-situ alternatives, this will support on expedited remediation of the site for redevelopment as a greenway along the river.

For AOC #2, based on the groundwater data collected during the 1999 SI, only one sample (and its duplicate) contained VOCs at concentrations exceeding RIDEM GB groundwater objectives. The required level of cleanup will be a major factor in determining the most feasible remedial technology for this site. The remedial alternatives discussed in the Remedial Evaluation Report are still appropriate with regards to the groundwater data collected during the SI. Specifically, these alternatives are:

- No Action/Natural Attenuation with Risk Assessment,
- Dual-Phase Extraction, and
- Soil Vapor Extraction and Air Sparging.

Three additional remedial alternatives have been briefly evaluated:

- Enhanced Biodegradation,
- Passive/Reactive Treatment Wall, and
- Excavation of Contaminated Soil at Water Table (extension of AOC #1).

As discussed in Section 5.1, Natural Attenuation is already occurring at AOC #2. Degradation products of TCE (cis-DCE, and VC) were found in every groundwater sample at levels that are greater than TCE, the parent compound. Furthermore, the concentrations of total ethenes (in terms of equivalent TCE) have decreased substantially from 1997 to 1999. The concentrations of chlorinated ethenes exceeded RIDEM GB groundwater objectives in 1997, but were below these standards at the end of 1999. If the rate of natural attenuation observed over the past two and a half years at MW-2 is applied to the concentrations observed in 1999 at MW99-5, it could be expected that these concentrations would degrade to less than the objective within approximately two years.

Technically, dual-phase extraction is a very viable remedial alternative for AOC #2, however, with the reduction in VOC concentrations already occurring at the site, the capital cost of the remedial system and volume of contaminants recovered by the system would not likely be of significant benefit. The lower

## GLOSSARY OF ABBREVIATIONS AND ACRONYMS

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### GLOSSARY OF ABBREVIATIONS AND ACRONYMS

AMRO	AMRO Environmental Laboratories Corporation
AOC	Area of Environmental Concern
ASTM	American Society for Testing and Materials
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
cis-DCE	cis (1,2)-dichloroethene
trans-DCE	trans (1,2)-dichloroethene
1,1-DCE	1,1-dichloroethene
DOT	U.S. Department of Transportation
DRO	<i>diesel range organics</i>
ELUR	Environmental Land Use Restriction
GBLC	RIDEM GB Leachability Criteria
GRO	gasoline range organics
HLA	Harding Lawson Associates
HSA	hollow-stem auger
I/C-DEC	RIDEM Industrial/Commercial Direct Exposure Criterion
ID	inside diameter
IDW	investigation-derived waste
LNAPL	lighter-than-water, non-aqueous phase liquid
MS/MSD	matrix spike/matrix spike duplicate
µg/kg	micrograms per kilogram
mg/kg	milligrams per kilogram
µg/L	micrograms per liter
mg/L	milligrams per liter
NAVD	North American Vertical Datum
NGVD	National Geodetic Vertical Datum
NTU	nephelometric turbidity unit
PAH	polynuclear aromatic hydrocarbon
PCE	tetrachloroethene
PID	photoionization detector
ppm	parts per million
QA	quality assurance
QC	quality control

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## GLOSSARY OF ABBREVIATIONS AND ACRONYMS

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R-DEC	RIDEM Residential Direct Exposure Criterion
RIDEM	Rhode Island Department of Environmental Management
SAP	Sampling and Analysis Plan
SI	Site Investigation
SSHP	Site Safety and Health Plan
STL	Severn Trent Laboratories
SVOC	semivolatile organic compound
TCE	trichloroethylene
TPH	total petroleum hydrocarbons
USACE-NAE	U.S. Army Corps of Engineers, New England District
USCS	Unified Soil Classification System
USEPA	U.S. Environmental Protection Agency
UST	underground storage tank
VC	vinyl chloride
VOC	volatile organic compound

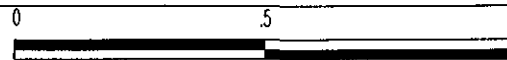
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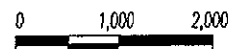


SOURCE: U.S.G.S. TOPOGRAPHIC 7.5 MINUTE SERIES:  
PROVIDENCE, RI 1957 PHOTOREVISED 1970 AND 1975

SCALE IN MILES



SCALE IN FEET

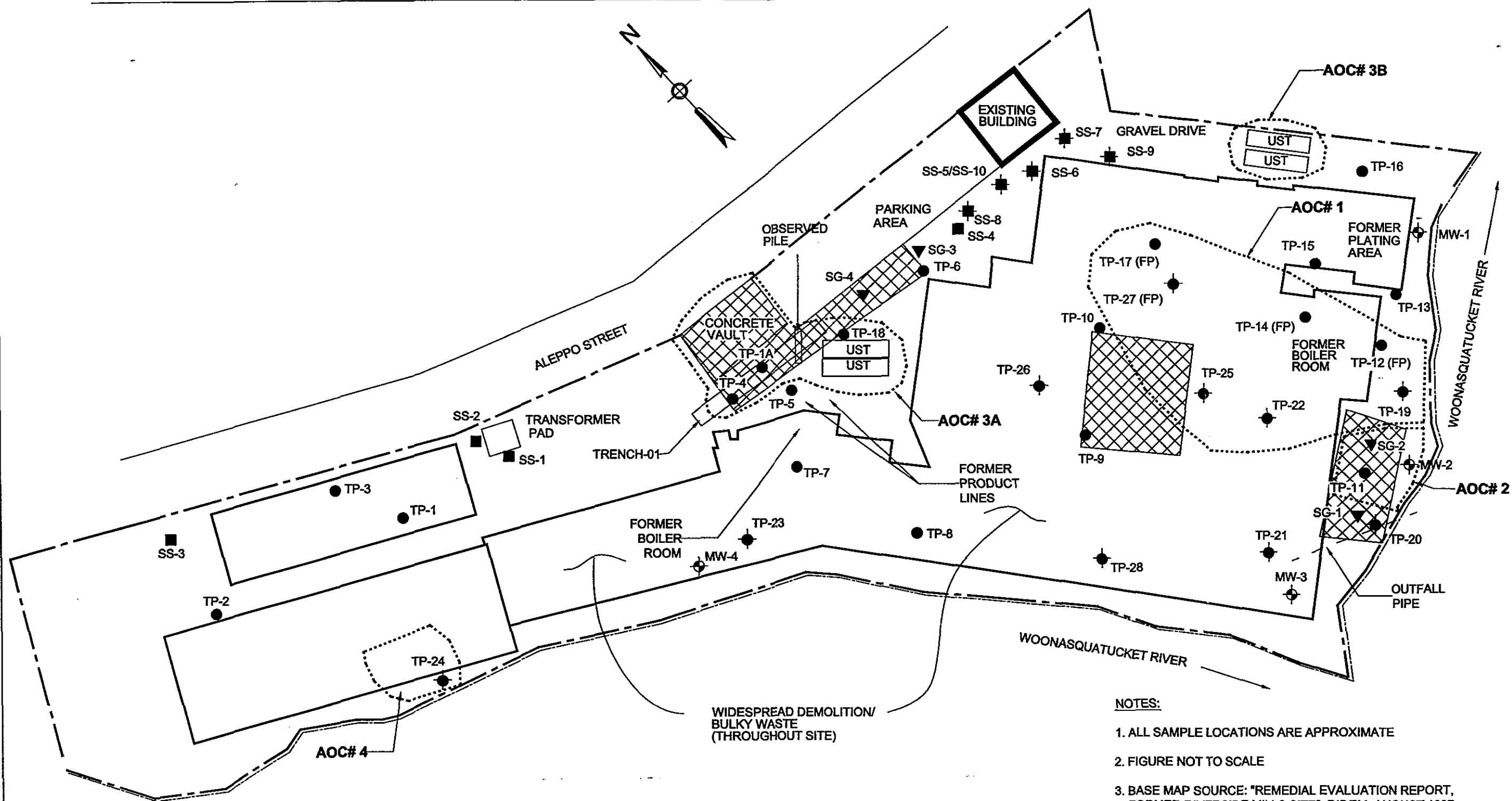


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**FIGURE 1-1**  
**SITE LOCATION MAP**  
**SITE INVESTIGATION**  
**FORMER RIVERSIDE MILLS**  
**BROWNFIELDS SITE**  
**PROVIDENCE, RI**







#### LEGEND

	PROPERTY LINE
	EDGE OF RIVER
	EXISTING BUILDING OUTLINE
	FORMER BUILDING OUTLINE
	AREAS INVESTIGATED WITH GEOPHYSICAL TECHNIQUES
	FP FREE PRODUCT
	AREAS OF ENVIRONMENTAL CONCERN (AOC)

MW-4		MONITORING WELL LOCATION
TP-1		TEST PIT LOCATION (10/28-29/96)
TP-19		TEST PIT LOCATION (4/23-24/97)
SS-1		SOIL SAMPLE LOCATION (10/28-29/96)
SS-5		SOIL SAMPLE LOCATION (4/23-24/97)
SG-1		SOIL GAS LOCATION

#### NOTES:

1. ALL SAMPLE LOCATIONS ARE APPROXIMATE
2. FIGURE NOT TO SCALE
3. BASE MAP SOURCE: "REMEDIAL EVALUATION REPORT, FORMER RIVERSIDE MILLS SITE", RIDEM, AUGUST 1997.

#### LIST OF AOCs

1. SEPARATE-PHASE OIL PLUME
2. VOCs IN GROUNDWATER @ MW-2
3. UNDERGROUND STORAGE TANKS (4) AND CONCRETE OIL VAULT
4. TPH-CONTAMINATED SOIL @ TP-24
5. SOLID WASTE/DEMOLITION RUBBLE (ENTIRE SITE)

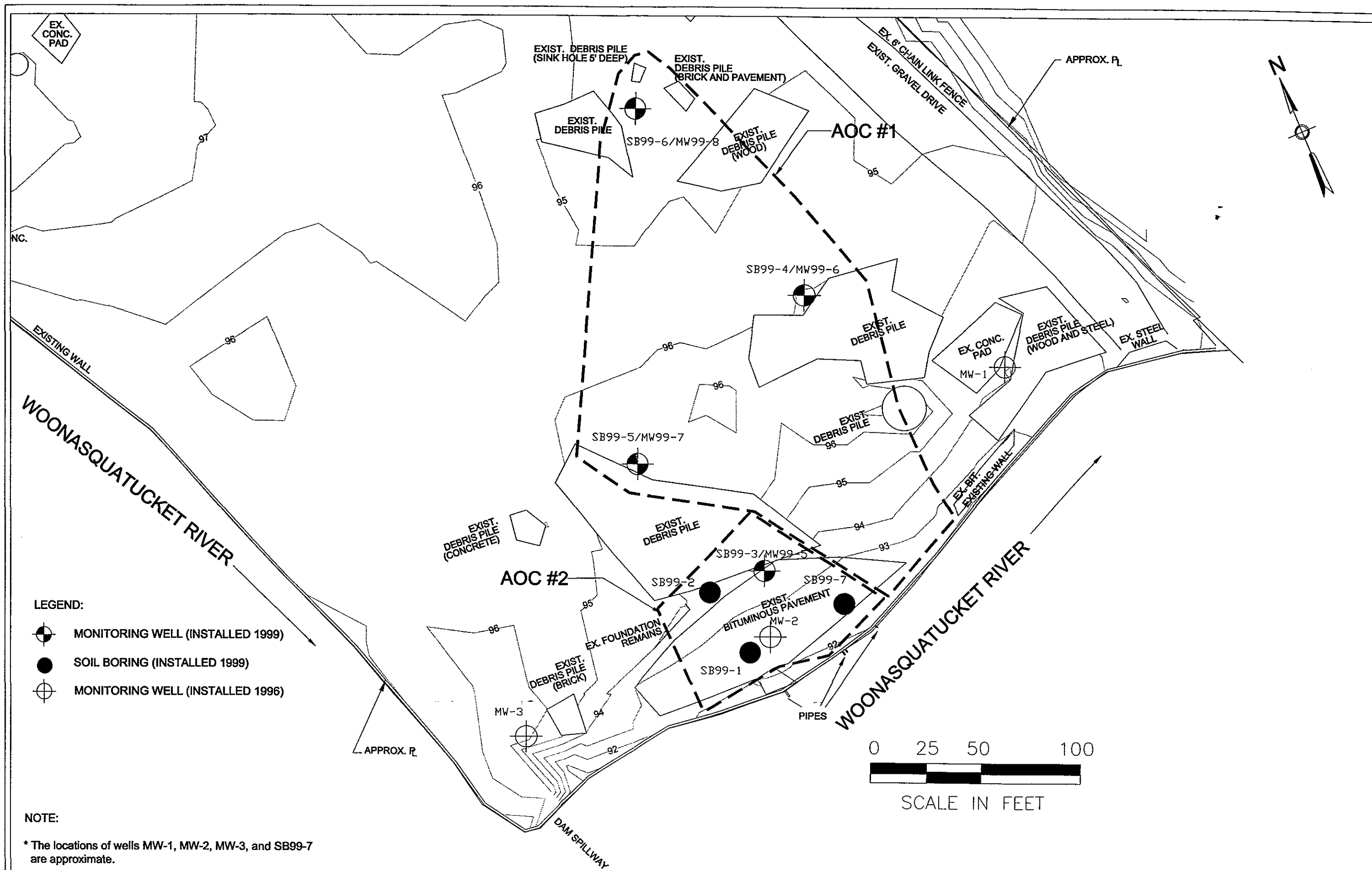
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 107 Auburton Road  
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 Waverfield, MA 01880  
 781-245-6606  
 DRAWN: MCR  
 JOB NUMBER: 48400.7  
 APPROVED:

INVESTIGATION LOCATIONS  
 1996-1997 REMEDIAL EVALUATION  
 FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
 PROVIDENCE, RI

FIGURE

2-1

FILE: RIVERSIDE MILLS.dwg  
 DATE: 1/00  
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Base map source: topographic survey of Former Riverside Mills, Brownfields Site, completed September 1999 by Fuss and O'Neill.



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INVESTIGATION LOCATIONS  
1999 SITE INVESTIGATION  
FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
PROVIDENCE, RI

APPROVED

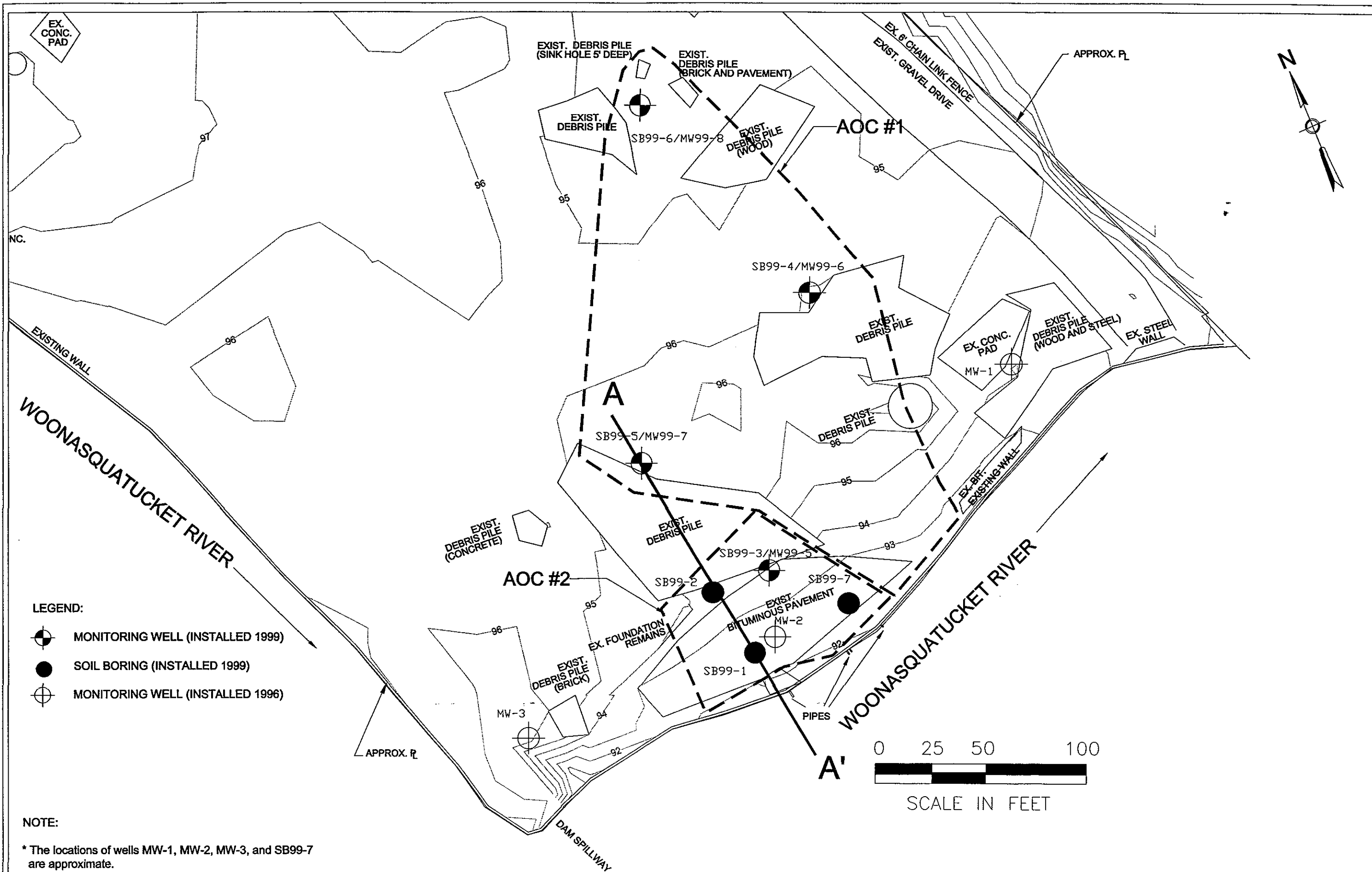
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FIGURE

3-

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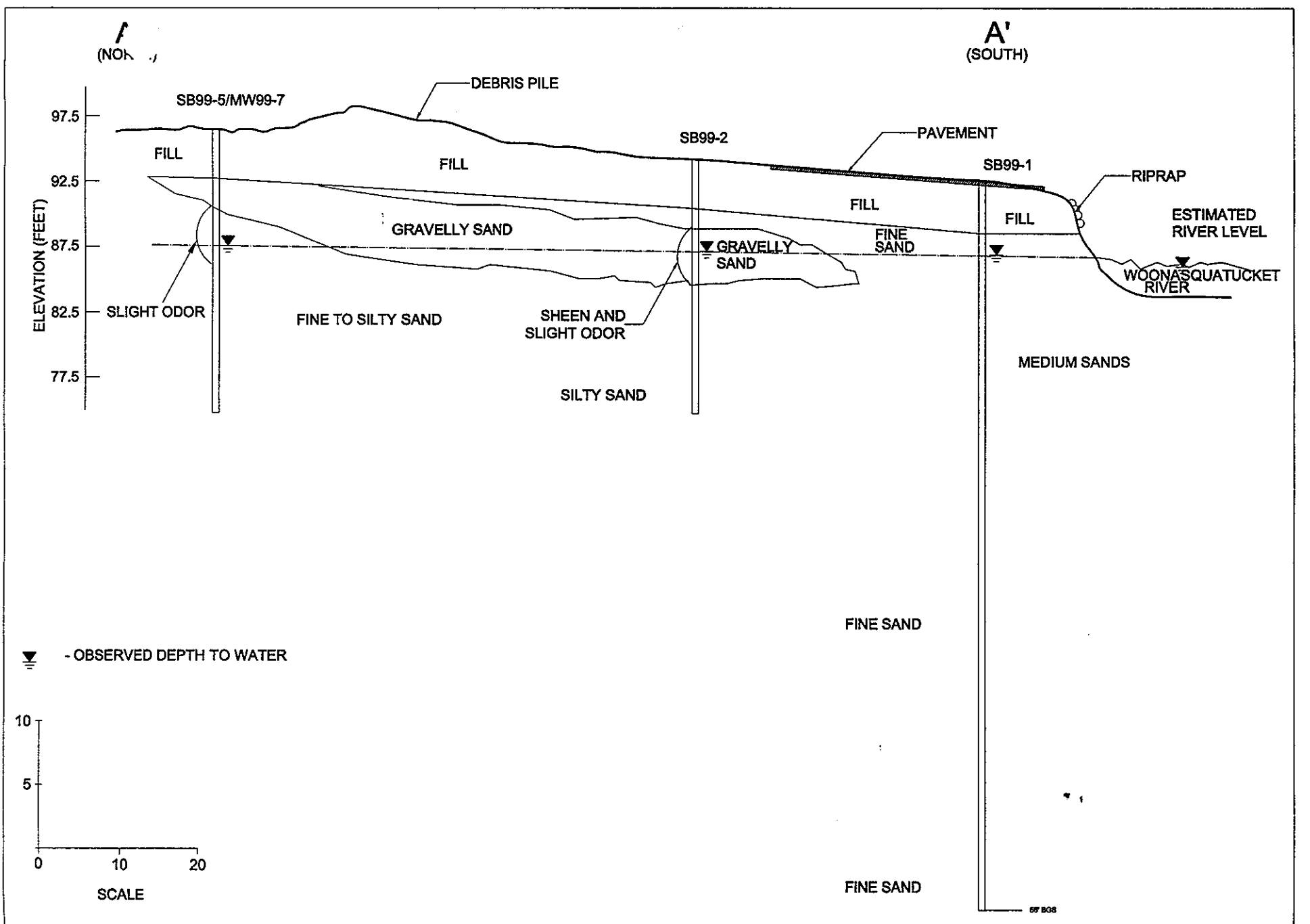
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LOCATION OF GEOLOGIC CROSS SECTION A-A'  
 FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
 PROVIDENCE, RI

APPROVED  
 FILE rmills-ts.dwg  
 DATE 1/00



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JOB NUMBER  
4R400 7

GEOLOGIC CROSS SECTION A-A'  
FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
PROVIDENCE, RI

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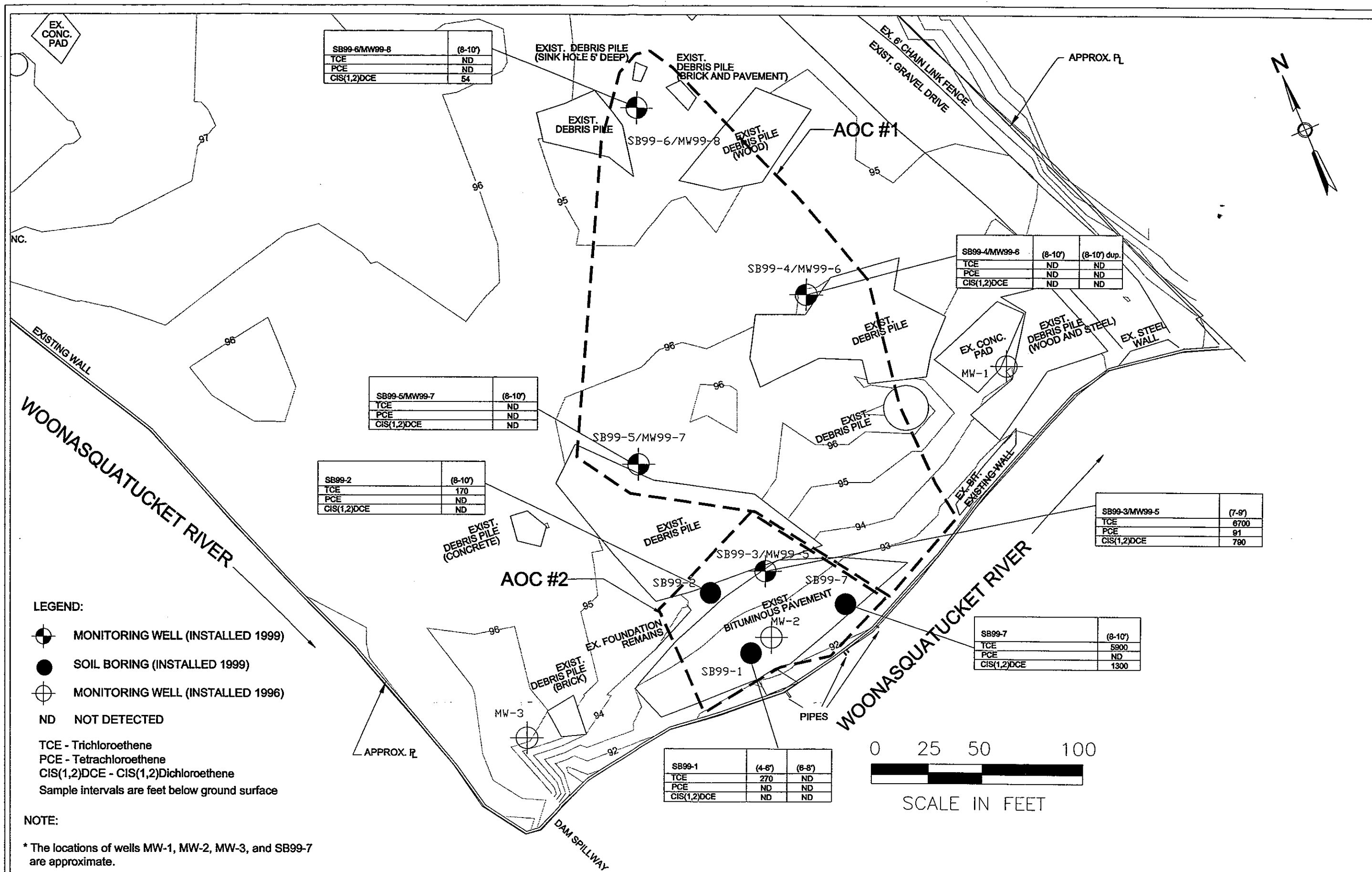
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FIGURE

3-3



Base map source: topographic survey of Former Riverside Mills, Brownfields Site, completed September 1999 by Fuss and O'Neill.



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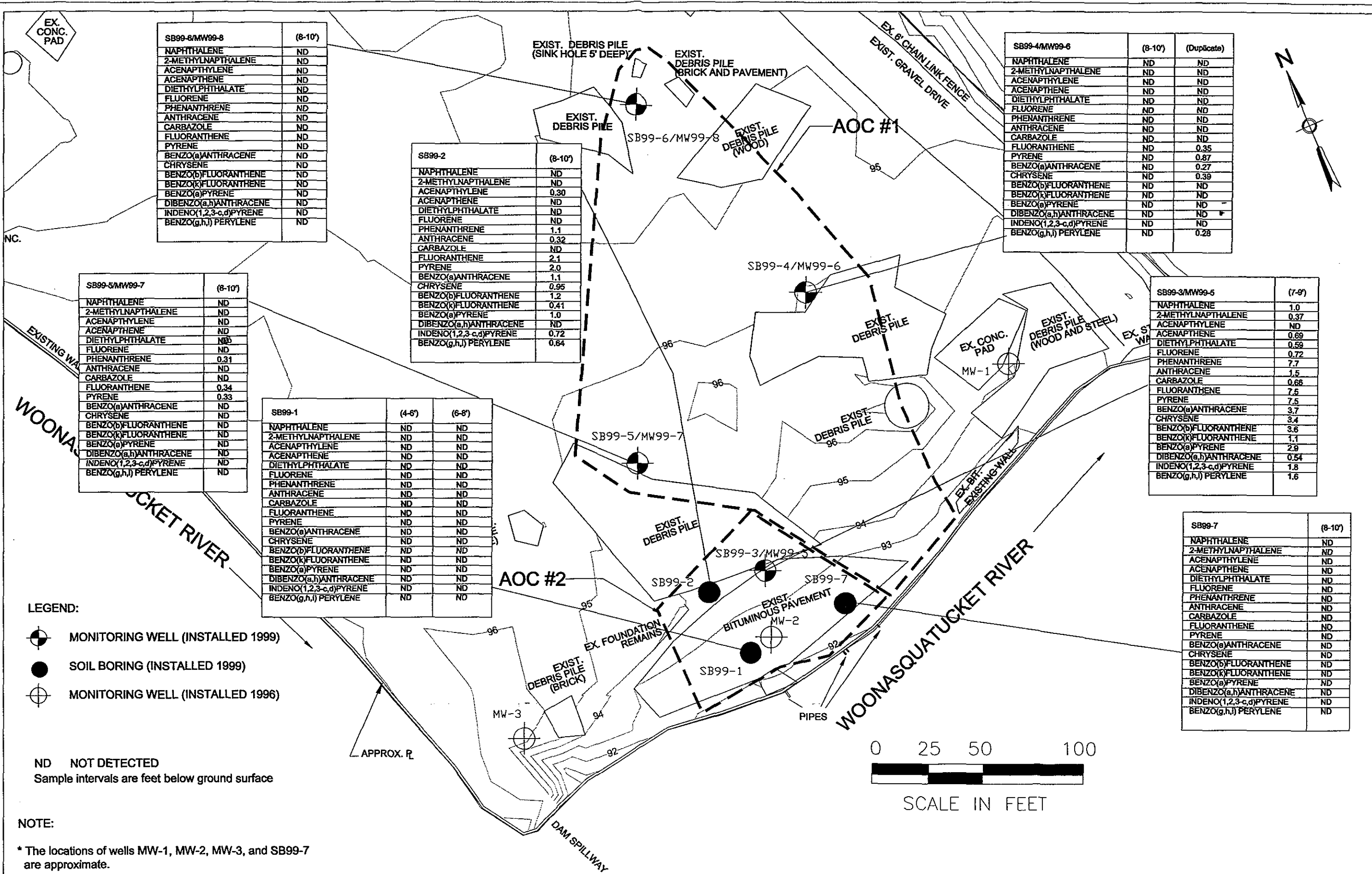
VOCs DETECTED IN SOIL (ug/kg)  
NOVEMBER 1999  
FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
PROVIDENCE, RI

APPROVED

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mills-ts.dwg

DATE  
1/00

FIGURE  
4-1  
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Base map source: topographic survey of Former Riverside Mills, Brownfields Site, completed September 1999 by Fuss and O'Neill.



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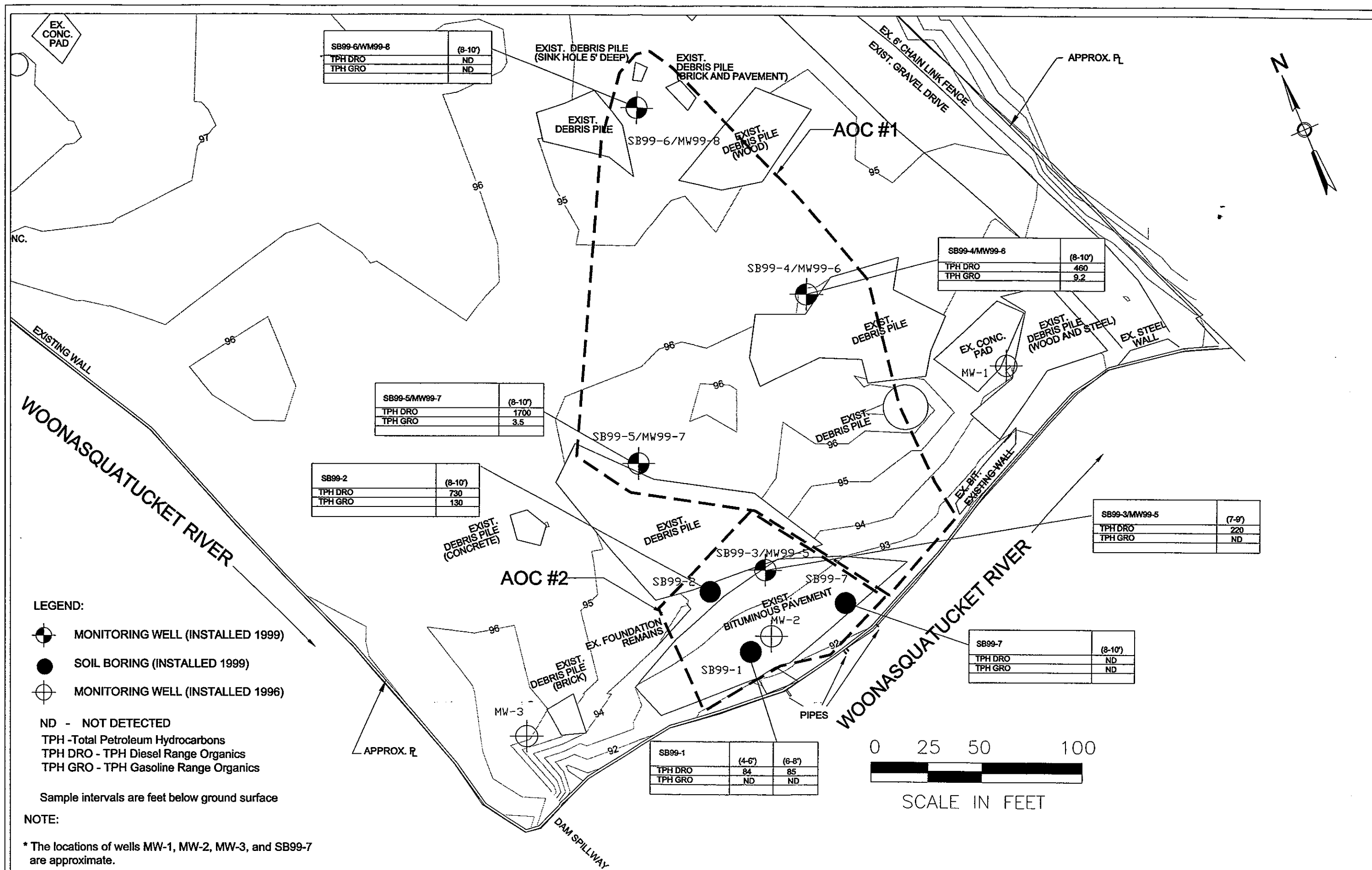
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JOB NUMBER 48400.7

SVOCs DETECTED IN SOIL (mg/kg)  
NOVEMBER 1999  
FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
PROVIDENCE, RI

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FIG

4-



Base map source: topographic survey of Former Riverside Mills, Brownfields Site, completed September 1999 by Fuss and O'Neill.



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48400.7

TPH DETECTED IN SOIL (mg/kg)  
NOVEMBER 1999  
FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
PROVIDENCE, RI

APPROVED

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mills-ts.dwg

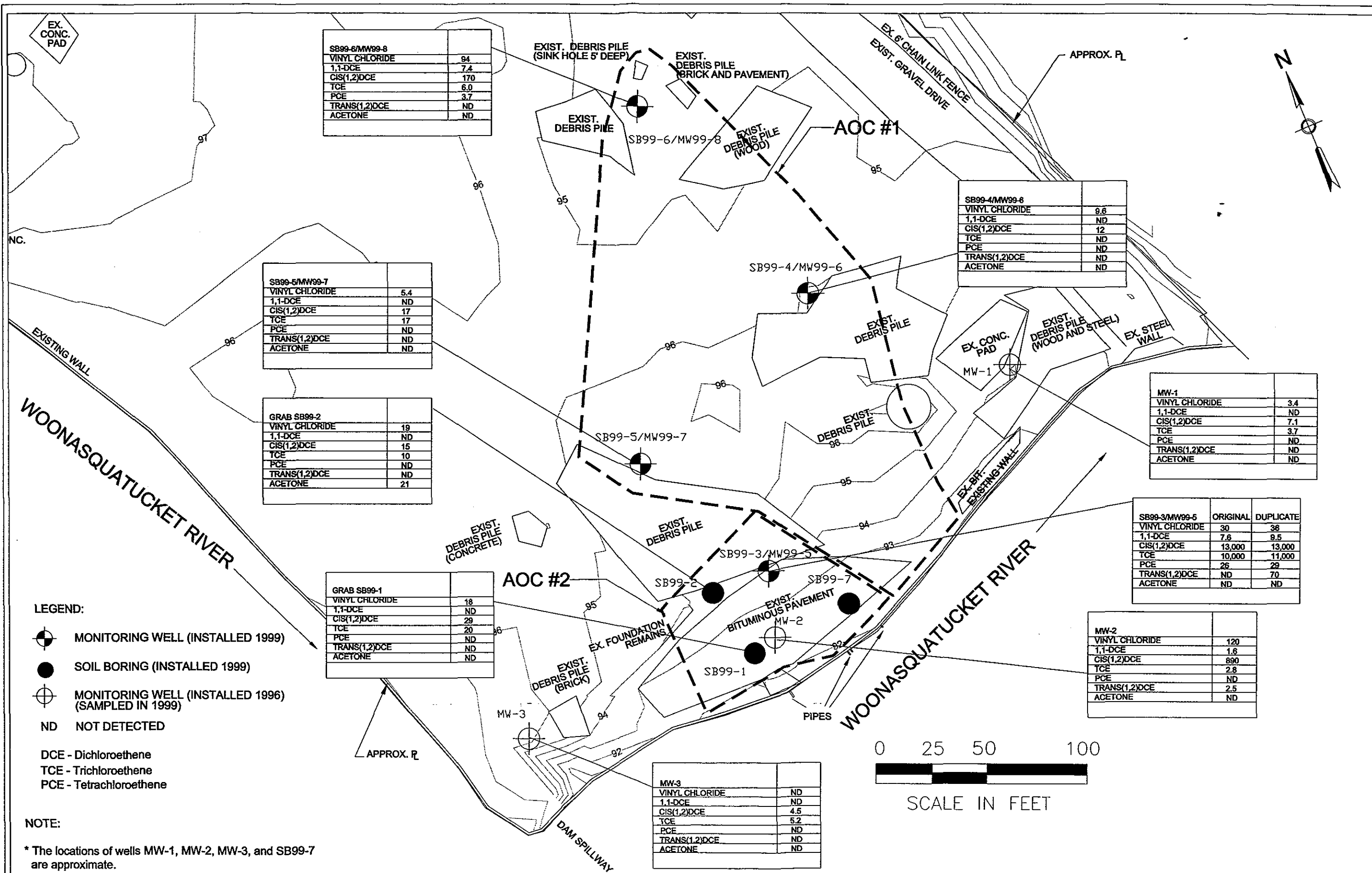
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FIGURE

4-3

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Base map source: topographic survey of Former Riverside Mills, Brownfields Site, completed September 1999 by Fuss and O'Neill.

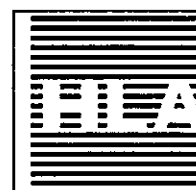
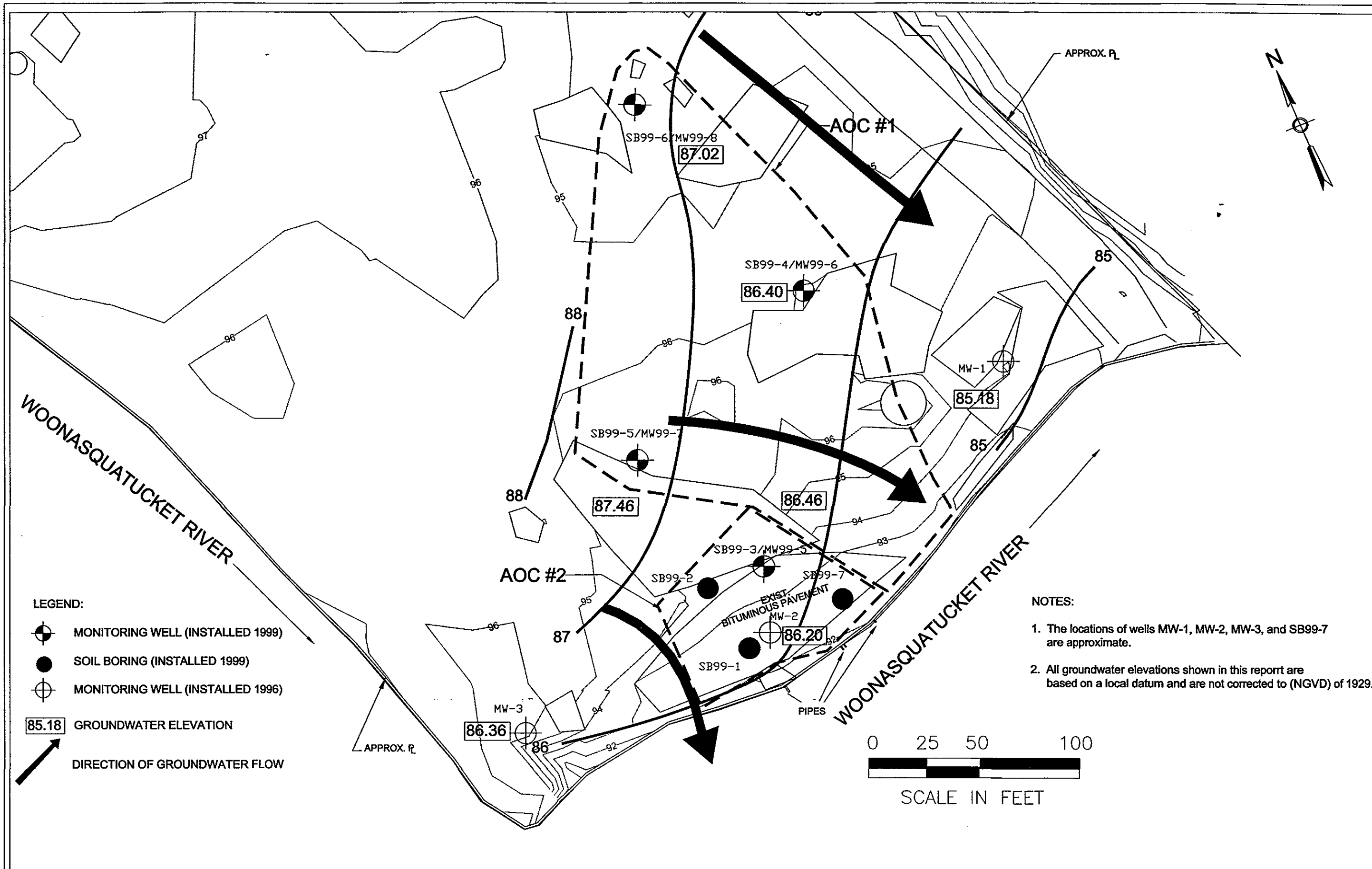


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VOCs DETECTED IN GROUNDWATER (ug/L)  
NOVEMBER 1999  
FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
PROVIDENCE, RI

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DATE 1/00

FIG  
4-  
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**SITE GROUNDWATER CONTOURS**  
NOVEMBER 1999  
FORMER RIVERSIDE MILLS BROWNFIELDS SITE  
PROVIDENCE, RI

DRAWN MCR  
JOB NUMBER 48400.7

APPROVED

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rmills-ts.dwg

DATE  
4/6/00

FIGURE

4-1

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**Table 3-1**  
**Summary of Water Table Elevations,**  
**November 18, 1999**  
**Former Riverside Mills Brownfields Site**  
**Providence, RI**

Monitoring Well	Approximate Casing Elevation (feet)	Approximate Elevation of Top of PVC (feet)	Depth to Water (feet below PVC)	Approximate Water Table Elevation (feet)
MW-1	94.20	94.04	8.86	85.18
MW-2	92.50	92.31	6.11	86.20
MW-3	93.30	93.02	6.66	86.36
MW99-5	93.57	93.11	6.71	86.40
MW99-6	96.00	95.52	9.12	86.40
MW99-7	96.26	95.92	8.46	87.46
MW99-8	94.75	94.44	7.42	87.02

Notes: 1. Water level measurements made on November 18, 1999.  
2. All elevations shown in this report are based on a local datum and not corrected to (NGVD) of 1929.

**Table 4-1**  
**Summary of Analytes Detected in Soil, November 1999**  
**Former Riverside Mills Brownfields Site**  
**Providence, RI**

	RIDEM Direct Exposure Criteria		RIDEM GB	SB99-1	SB99-1	SB99-2	SB99-3	SB99-4
Parameter	Residential	Industrial/ Commercial	Leachability Criteria	(4-6') RMBS0104XXXX	(6-8') RMBS0106XXXX	(8-10') RMBS0208XXXX	(7-9') RMBS0307XXXX	(8-10') RMBS0408XXXX
Volatile Organics (µg/Kg)								
1,2-Dichloroethene (cis)	630,000	10,000,000	60,000	33 U	28 U	23 U	790	31 U
Tetrachloroethene	12,000	110,000	4,200	33 U	28 U	23 U	91	31 U
Trichloroethene	13,000	520,000	20,000	270	28 U	170	6700	31 U
Semivolatile Organics (mg/Kg)								
2-Methylnaphthalene	123	10,000	--	0.3 U	0.28 U	0.28 U	0.37	0.27 U
Acenaphthene	43	10,000	--	0.3 U	0.28 U	0.28 U	0.69	0.27 U
Acenaphthylene	23	10,000	--	0.3 U	0.28 U	0.3	0.26 U	0.27 U
Anthracene	35	10,000	--	0.3 U	0.28 U	0.32	1.5	0.27 U
Benzo(a)Anthracene	0.9	7.8	--	0.3 U	0.28 U	1.1	3.7	0.27 U
Benzo(a)Pyrene	0.4	0.8	--	0.3 U	0.28 U	1	2.9	0.27 U
Benzo(b)Fluoranthene	0.9	7.8	--	0.3 U	0.28 U	1.2	3.6	0.27 U
Benzo(g,h,i)Perylene	0.8	10,000	--	0.3 U	0.28 U	0.64	1.6	0.27 U
Benzo(k)Fluoranthene	0.9	78	--	0.3 U	0.28 U	0.41	1.1	0.27 U
Carbazole	--	--	--	0.3 U	0.28 U	0.28 U	0.66	0.27 U
Chrysene	0.4	780	--	0.3 U	0.28 U	0.95	3.4	0.27 U
Dibenzo(a,h)Anthracene	0.4	0.8	--	0.3 U	0.28 U	0.28 U	0.64	0.27 U
Diethylphthalate	1,900	10,000	--	0.3 U	0.28 U	0.28 U	0.59	0.27 U
Fluoranthene	20	10,000	--	0.3 U	0.28 U	2.1	7.5	0.27 U
Fluorene	28	10,000	--	0.3 U	0.28 U	0.28 U	0.72	0.27 U
Indeno(1,2,3-c,d)Pyrene	0.9	7.8	--	0.3 U	0.28 U	0.72	1.8	0.27 U
Naphthalene	54	10,000	--	0.3 U	0.28 U	0.28 U	1	0.27 U
Phenanthrene	40	10,000	--	0.3 U	0.28 U	1.1 U	7.7	0.27 U
Pyrene	13	10,000	--	0.3 U	0.28 U	2	7.5	0.27 U
Total Petroleum Hydrocarbons (mg/Kg)								
Diesel Range Organics (DRO)*	500	2500	2500	84	85	730	220	460
Gasoline Range Organics (GRO)*	500	2500	2500	3.3 U	2.8 U	130	2.4 U	9.2

**Notes:**

Shaded boxes indicate the detected concentration exceeds one or more RIDEM criterion.

-- = no applicable standard

NA = not analyzed

U = analyte was not detected above the reporting limit shown

J = estimated concentration

\* DRO/GRO added together equates to RIDEM's TPH DEC/GBLC value in Remediation Regulations Section 8.02A

**Table 4-1**  
**Summary of Analytes Detected in Soil, November 1999**  
**Former Riverside Mills Brownfields Site**  
**Providence, RI**

Parameter	RIDEM Direct Exposure Criteria		RIDEM GB	RMB0909XXXX	SB99-5	SB99-6	SB99-7	Trip Blank
	Residential	Industrial/ Commercial	Leachability Criteria	(blind duplicate of RMB0408XXXX)	(8-10') RMB0508XXXX	(8-10') RMB0608XXXX	(8-10') RMB0708XXXX	RMQTXXXX01XX
Volatile Organics (µg/Kg)								
1,2-Dichloroethene (cis)	630,000	10,000,000	60,000	33 U	27 U	54	1300	25 U
Tetrachloroethene	12,000	110,000	4,200	33 U	27 U	34 U	34 U	25 U
Trichloroethene	13,000	520,000	20,000	33 U	27 U	34 U	5900	25 U
Semivolatile Organics (mg/Kg)								
2-Methylnaphthalene	123	10,000	--	0.27 U	0.27 U	0.31 U	0.3 U	NA
Acenaphthene	43	10,000	--	0.27 U	0.27 U	0.31 U	0.3 U	NA
Acenaphthylene	23	10,000	--	0.27 U	0.27 U	0.31 U	0.3 U	NA
Anthracene	35	10,000	--	0.27 U	0.27 U	0.32 U	0.3 U	NA
Benzo(a)Anthracene	0.9	7.8	--	0.27	0.27 U	0.32 U	0.3 U	NA
Benzo(a)Pyrene	0.4	0.8	--	0.27 U	0.27 U	0.32 U	0.3 U	NA
Benzo(b)Fluoranthene	0.9	7.8	--	0.27 U	0.27 U	0.32 U	0.3 U	NA
Benzo(g,h,i)Perylene	0.8	10,000	--	0.28	0.27 U	0.32 U	0.3 U	NA
Benzo(k)Fluoranthene	0.9	78	--	0.27 U	0.27 U	0.32 U	0.3 U	NA
Carbazole	--	--	--	0.27 U	0.27 U	0.32 U	0.3 U	NA
Chrysene	0.4	780	--	0.39	0.27 U	0.32 U	0.3 U	NA
Dibenzo(a,h)Anthracene	0.4	0.8	--	0.27 U	0.27 U	0.32 U	0.3 U	NA
Diethylphthalate	1,900	10,000	--	0.27 U	0.27 U	0.31 U	0.3 U	NA
Fluoranthene	20	10,000	--	0.35 U	0.34 U	0.32 U	0.3 U	NA
Fluorene	28	10,000	--	0.27 U	0.27 U	0.31 U	0.3 U	NA
Indeno(1,2,3-c,d)Pyrene	0.9	7.8	--	0.27 U	0.27 U	0.32 U	0.3 U	NA
Naphthalene	54	10,000	--	0.27 U	0.27 U	0.31 U	0.3 U	NA
Phenanthrene	40	10,000	--	0.27 U	0.31 U	0.32 U	0.3 U	NA
Pyrene	13	10,000	--	0.87 U	0.33 U	0.32 U	0.3 U	NA
Total Petroleum Hydrocarbons (mg/Kg)								
Diesel Range Organics (DRO)*	500	2500	2500	1000	1700	62 UJ	60 U	NA
Gasoline Range Organics (GRO)*	500	2500	2500	3.3 U	3.5	3.4 U	3.4 U	NA

**Notes:**

Shaded boxes indicate the detected concentration exceeds one or more RIDEM criterion.

-- = no applicable standard

NA = not analyzed

U = analyte was not detected above the reporting limit shown

J = estimated concentration

\* DRO/GRO added together equates to RIDEM's TPH DEC/GBLC value  
in Remedial Regulations Section 8.02A

**Table 4-2**  
**Summary of Analytes Detected in Groundwater, November 1999**  
**Former Riverside Mills Brownfields Site**  
**Providence, RI**

Parameter	RIDEM Method 1 GB Groundwater Objective	SB99-1 RMBW01XX01XX	SB99-2 RMBW02XX01XX	MW-1 RMGW01XX01XX	MW-2 RMGW02XX01XX	MW-3 RMGW03XX01XX	MW99-5 RMGW05XX01XX	RMGW09XX01XX (blind duplicate of RMGW05XX01XX)	MW99-6 RMGW06XX01XX
<b>Volatile Organics (µg/L)</b>									
1,1-Dichloroethane	--	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1.6 J	1 U	7.6 J	9.5 J	1 U
1,2-Dichloroethene (cis)	2,400	29	15	7.1	890	4.5	13000	13000	12
1,2-Dichloroethene (trans)	2,800	2 U	2 U	2 U	2.5 J	2 U	61 J	70	2 U
Acetone	--	10 U	21	10 U	10 U	10 U	10 UJ	10 U	10 U
Tetrachloroethene	150	2 U	2 U	2 U	2 U	2 U	26 J	29	2 U
Trichloroethene	540	20	10	3.7	2.8 J	5.2	10000	10000	2 U
Vinyl Chloride	--	18	19	3.4	120 J	2 U	30 J	36	9.6
<b>Semivolatile Organics (µg/L)</b>									
Benzo(a)Anthracene	--	10 U	20	10 U	10 U	10 U	11 U	11 U	10 U
Benzo(a)Pyrene	--	10 U	16	10 U	10 U	10 U	11 U	11 U	10 U
Benzo(b)Fluoranthene	--	10 U	25	10 U	10 U	10 U	11 U	11 U	10 U
Benzo(g,h,i)Perylene	--	10 U	15	10 U	10 U	10 U	11 U	11 U	10 U
Bis(2-Ethylhexyl)Phthalate	--	10 U	20	10 U	10 U	10 U	11 U	11 U	10 U
Chrysene	--	10 U	20	10 U	10 U	10 U	11 U	11 U	10 U
Fluoranthene	--	10 U	42	10 U	10 U	10 U	11 U	11 U	10 U
Indeno(1,2,3-c,d)Pyrene	--	10 U	16	10 U	10 U	10 U	11 U	11 U	10 U
Pyrene	--	10 U	42	10 U	10 U	10 U	11 U	11 U	10 U
<b>Total Petroleum Hydrocarbons (mg/L)</b>									
Diesel Range Organics (DRO)	--	1 U	4 J	1 U	1 U	1 U	1 U	1 U	1 U
Gasoline Range Organics (GRO)	--	0.1 U	0.59	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U	0.1 U

**Notes:**

Shaded boxes indicate the detected concentration exceeds the applicable GB Groundwater Objective.

-- = no applicable standard

NA = not analyzed

U = analyte was not detected above the reporting limit shown

J = estimated concentration

mg/L = milligrams per liter

µg/L = micrograms per liter

**Table 4-2**  
**Summary of Analytes Detected in Groundwater, November 1999**  
**Former Riverside Mills Brownfields Site**  
**Providence, RI**

Parameter	RIDEM Method 1 GB Groundwater Objective	MW99-7 RMGW07XX01XX	MW99-8 RMGW08XX01XX	Rinsate Blank RMQS01XXXXXX	Trip Blank RMQTXXXX02XX	Trip Blank RMQTXXXX03XX	Trip Blank RMQTXXXX04XX	Trip Blank RMQTXXXX06XX
<b>Volatile Organics (µg/L)</b>								
1,1-Dichloroethane	—	2 U	7.4	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethene	7	1 U	1 U	1 U	1 U	1 U	1 U	1 U
1,2-Dichloroethene (cis)	2,400	17	170	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethene (trans)	2,800	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Acetone	—	10 U	10 U	10 U	120	10 U	10 U	10 U
Tetrachloroethene	150	2 U	3.7	2 U	2 U	2 U	2 U	2 U
Trichloroethene	540	17	6 J	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	—	5.4	94	2 U	2 U	2 U	2 U	2 U
<b>Semivolatile Organics (µg/L)</b>								
Benzo(a)Anthracene	—	10 U	10 U	10 U	NA	NA	NA	NA
Benzo(a)Pyrene	—	10 U	10 U	10 U	NA	NA	NA	NA
Benzo(b)Fluoranthene	—	10 U	10 U	10 U	NA	NA	NA	NA
Benzo(g,h,i)Perylene	—	10 U	10 U	10 U	NA	NA	NA	NA
Bis(2-Ethylhexyl)Phthalate	—	10 U	10 U	10 U	NA	NA	NA	NA
Chrysene	—	10 U	10 U	10 U	NA	NA	NA	NA
Fluoranthene	—	10 U	10 U	10 U	NA	NA	NA	NA
Indeno(1,2,3-c,d)Pyrene	--	10 U	10 U	10 U	NA	NA	NA	NA
Pyrene	--	10 U	10 U	10 U	NA	NA	NA	NA
<b>Total Petroleum Hydrocarbons (mg/L)</b>								
Diesel Range Organics (DRO)	—	1 U	1 U	NA	NA	NA	NA	NA
Gasoline Range Organics (GRO)	—	0.1 U	0.1 U	NA	NA	NA	NA	NA

**Notes:**

Shaded boxes indicate the detected concentration  
exceeds the applicable GB Groundwater Objective.

— = no applicable standard

NA = not analyzed

U = analyte was not detected above the  
reporting limit shown

J = estimated concentration

mg/L = milligrams per liter

µg/L = micrograms per liter

## **APPENDIX A**

### **RIDEM DIRECT EXPOSURE CRITERIA AND LEACHABILITY CRITERIA**

Reprinted from "Rules and Regulations for the Investigation and Remediation of Hazardous Material Releases", Rhode Island Department of Environmental Management, Division of Site Remediation, Regulation DEM-DSR-01-93, issued March 31, 1993, and amended August 1996.



TABLE 1

DIRECT EXPOSURE CRITERIA		
Substance	Residential (mg/kg)	Industrial/Commercial (mg/kg)
<b>Volatile Organics</b>		
Acetone	7,800	10,000
Benzene	2.5	200
Bromodichloromethane	10	92
Bromoform	81	720
Bromomethane	0.8	2900
Carbon tetrachloride	1.5	44
Chlorobenzene	210	10,000
Chloroform	1.2	940
Dibromochloromethane	7.6	68
Dibromochloropropane (DBCP)	0.5	4.1
Dichloroethane (1,1-)	920	10,000
Dichloroethane (1,2-)	0.9	63
Dichloroethene (1,1-)	0.2	9.5
Dichloroethene (cis-1,2-)	630	10,000
Dichloroethene (trans-1,2-)	1,100	10,000
Dichloropropane (1,2)	1.9	84
Ethyl benzene	71	10,000
Ethylene dibromide (EDB)	0.01	0.07
Isopropyl benzene	27	10,000
Methyl ethyl ketone	10,000	10,000
Methyl isobutyl ketone	1200	10,000
Methyl-tert-butyl-ether (MTBE)	390	10,000
Methylene chloride	45	760
Styrene	13	190
Tetrachloroethane, 1,1,1,2	2.2	220

TABLE 1

DIRECT EXPOSURE CRITERIA		
Substance	Residential (mg/kg)	Industrial/Commercial (mg/kg)
Tetrachloroethane, 1,1,2,2	1.3	29
Tetrachloroethylene	12	110
Toluene	190	10,000
Trichloroethane, 1,1,1-	540	10,000
Trichloroethane, 1,1,2-	3.6	100
Trichloroethylene	13	520
Vinyl chloride	0.02	3.0
Xylenes (Total)	110	10,000
<b>Semivolatiles</b>		
Acenaphthene	43	10,000
Acenaphthylene	23	10,000
Anthracene	35	10,000
Benzo(a)anthracene	0.9	7.8
Benzo(a)pyrene <sup>a</sup>	0.4	0.8
Benzo(b)fluoranthene	0.9	7.8
Benzo(g,h,i)perylene	0.8	10,000
Benzo(k)fluoranthene	0.9	78
Biphenyl, 1,1-	0.8	10,000
Bis(2-ethylhexyl)phthalate	46	410
Bis(2-chloroethyl)ether	0.6	5.2
Bis(2-chloroisopropyl)ether	9.1	82
Chloroaniline, 4- (p-)	310	8200
Chlorophenol, 2-	50	10,000
Chrysene	0.4	780
Dibenzo(a,h)anthracene <sup>a</sup>	0.4	0.8
Dichlorobenzene, 1,2- (o-DCB)	510	10,000

TABLE 1

DIRECT EXPOSURE CRITERIA		
Substance	Residential (mg/kg)	Industrial/Commercial (mg/kg)
Dichlorobenzene, 1,3- (m-DCB)	430	10,000
Dichlorobenzene, 1,4- (p-DCB)	27	240
Dichlorobenzidine, 3,3-	1.4	13
Dichlorophenol, 2,4-	30	6,100
Diethyl phthalate	340	10,000
Dimethyl phenol, 2,4-	1,400	10,000
Dimethyl phthalate	1900	10,000
Dinitrophenol, 2,4-	160	4,100
Dinitrotoluene, 2,4-	0.9	8.4
Fluoranthene	20	10,000
Fluorene	28	10,000
Hexachlorobenzene	0.4	3.6
Hexachlorobutadiene	8.2	73
Hexachloroethane	46	410
Indeno(1,2,3-cd)pyrene	0.9	7.8
Methyl naphthalene, 2-	123	10,000
Naphthalene	54	10,000
Pentachlorophenol	5.3	48
Phenanthrene	40	10,000
Phenol	6,000	10,000
Pyrene	13	10,000
Trichlorobenzene, 1,2,4-	96	10,000
Trichlorophenol, 2,4,5-	330	10,000
Trichlorophenol, 2,4,6-	58	520

TABLE 1

DIRECT EXPOSURE CRITERIA		
Substance	Residential (mg/kg)	Industrial/Commercial (mg/kg)
<b>Pesticides/PCBs</b>		
Chlordane	0.5	4.4
Dieldrin	0.04	0.4
Polychlorinated biphenyls (PCBs) <sup>b</sup>	10	10
<b>Inorganics</b>		
Antimony	10	820
Arsenic <sup>c</sup>	1.7	3.8
Barium	5,500	10,000
Beryllium <sup>c</sup>	0.4	1.3
Cadmium	39	1,000
Chromium III (Trivalent)	1,400	10,000
Chromium VI (Hexavalent)	390	10,000
Copper	3,100	10,000
Cyanide	200	10,000
Lead <sup>d</sup>	150	500
Manganese	390	10,000
Mercury	23	610
Nickel	1,000	10,000
Selenium	390	10,000
Silver	200	10,000
Thallium	5.5	140
Vanadium	550	10,000
Zinc	6,000	10,000

<sup>a</sup> Estimated quantitation limits

<sup>b</sup> Direct exposure criteria for PCBs consistent with the Toxic Substance Control Act (TSCA)

<sup>c</sup> Background Levels of Priority Pollutant Metals In Rhode Island Soils, T. O'Connor, RIDEM

<sup>d</sup> Direct exposure criteria for Lead consistent with the Rhode Island Department of Health Rules and Regulations for Lead Poisoning Prevention [R23-24.6-PB], as amended

TABLE 2

LEACHABILITY CRITERIA		
Substance	GA Leachability (mg/kg except as otherwise noted)	GB Leachability (mg/kg)
<b>Volatile Organics</b>		
Benzene	0.2	4.3
Carbon tetrachloride	0.4	5.0
Chlorobenzene	3.2	100
Dichloroethane (1,2-)	0.1	2.3
Dichloroethylene (1,1-)	0.7	0.7
Dichloroethylene (cis-1,2-)	1.7	60
Dichloroethylene (trans-1,2-)	3.3	92
Dichloropropane (1,2)	0.1	70
Ethylbenzene	27	62
Ethylene dibromide (EDB)	5E-04	-
Methyl-tert-butyl-ether (MTBE)	0.9	100
Styrene	2.9	64
Tetrachloroethylene	0.1	4.2
Toluene	32	54
Trichloroethane (1,1,1-)	11	160
Trichloroethane (1,1,2-)	0.1	-
Trichloroethylene	0.2	20
Vinyl chloride	0.3	-
Xylenes	540	-
<b>Semivolatiles</b>		
Benzo(a)pyrene	240	-
Dichlorobenzene (all isomers)	41	-
Diethylhexyl phthalate	120	-

TABLE 2

LEACHABILITY CRITERIA		
Substance	GA Leachability (mg/kg, except as otherwise noted)	GB Leachability (mg/kg)
Naphthalene	0.8	-
Pentachlorophenol	7.1	-
Trichlorobenzene (1,2,4-)	140	-
<b>Pesticides/PCBs</b>		
Chlordane	1.4	-
Polychlorinated biphenyls (PCBs) <sup>a</sup>	10.0	10.0
Substance	GA Leachability (mg/l)	
<b>Inorganics</b>		
Antimony (TCLP/SPLP)	0.05	-
Barium (TCLP/SPLP)	23	-
Beryllium (TCLP/SPLP)	0.03	-
Cadmium (TCLP/SPLP)	0.03	-
Chromium (TCLP/SPLP)	1.1	-
Cyanide (TCLP/SPLP)	2.4	-
Lead (TCLP/SPLP)	0.04	-
Mercury (TCLP/SPLP)	0.02	-
Nickel (TCLP/SPLP)	1	-
Selenium (TCLP/SPLP)	0.6	-
Thallium (TCLP/SPLP)	0.005	-

"-" No Method 1 GB Leachability Criteria promulgated

<sup>a</sup> Leachability criteria for PCBs consistent with the Toxic Substance Control Act (TSCA)

GB GROUNDWATER OBJECTIVES	
Substance	GB Groundwater Objective (mg/l)
Benzene	0.14
Carbon Tetrachloride	0.07
Chlorobenzene	3.2
Dibromochloropropane (DBCP)	0.002
Dichloroethane (1,2-)	0.11
Dichloroethylene (1,1-)	0.007
Dichloroethylene (cis-1,2-)	2.4
Dichloroethylene (trans-1,2-)	2.8
Dichloropropane (1,2-)	3.0
Ethylbenzene	1.6
Styrene	2.2
Methyl Tertiary Butyl Ether (MTBE)	5.0
Tetrachloroethylene	0.15
Toluene	1.7
Trichloroethane (1,1,1-)	3.1
Trichloroethylene	0.54

C. Method 2 GB Groundwater Objectives:

Method 2 allows for the consideration of limited site-specific information to modify Method 1 GB Groundwater Objectives or to calculate GB Groundwater Objectives for hazardous substances in groundwater not listed in Table 4, but which have the potential to volatilize. For the purposes of these regulations, a Method 2 GB Groundwater Objective shall refer to any groundwater objective which has addressed site-specific conditions pursuant to this Rule and in accordance with the appropriate information presented in Appendix F.

TABLE 5

UPPER CONCENTRATION LIMITS FOR GB GROUNDWATER	
Substance	GB Groundwater UCL (mg/l)
Benzene	48
Chlorobenzene	56
Dichloroethane (1,2-)	670
Dichloroethene (1,1-)	23
Dichloroethene (cis-1,2-)	69
Dichloroethene (trans-1,2-)	79
Dichloropropane (1,2-)	140
Ethyl Benzene	16
Styrene	50
Toluene	21
Trichloroethane (1,1,1-)	68
Trichloroethylene	87

#### 8.08 Points of Compliance:

##### A. Points of Compliance for Soils:

- i. The points of compliance for soils are points where the soil objectives established under Rule 8.02 (Soil Objectives) or Rule 8.04 (Method 3 Remedial Objectives) shall be attained. For soil objectives based on direct exposure to humans engaged in residential or industrial/commercial activities, the point of compliance shall be established in the soils throughout the contaminated-site, except as otherwise specified in Rule 8.02.A.i (General Requirements for Direct Exposure Criteria). For soil objectives based on protection of GA/GAA or GB areas, the points of compliance shall be established throughout the contaminated-site in a manner consistent with Rule 8.02.A.ii (General Requirements for Leachability Criteria).



**APPENDIX B**  
**SOIL BORING LOGS**



### Soil Boring Log

Harding Lawson Associates  
107 Audubon Road  
Wakefield, MA

### Boring Location:

**SB99-1**

Project Name: Riverside Mills

HLA Geologist:

M. Phaneuf

Date Started: 11/11/99

Drilling Company:

GeoLogic

Date Completed: 11/11/99

Drilling Method:

Drive & Wash

Total Depth: 56 ft.

Depth to Water:

~ 5 ft.

### Comments:

-

Depth (feet)	Stratigraphy Description	USCS Class.	Penetration/ Recovery (feet)	Headspace (ppm)	Blows/ 6 inches	Sample IDs
0.5-2.0	Top 6"- Drilled through asphalt. Then: sand, medium to well graded, 5% gravel to 0.5" maximum, wet, medium grained, brown, contains red brick, fill	SW	1.5/1.0	0	95-40-13	S-1
2-4	Sand, poorly graded, 5% gravel to 0.5" maximum, wet, tan, medium grained, contains red brick, burned and unburned wood fragments, glass, and clinker-like material, fill	SP	2.0/1.0	0	11-9-6-5	S-2
4-6	Sand, poorly graded, saturated at 5 ft., tan, medium dense, medium grained, slight odor	SP	2.0/1.3	46.1	4-6-17-13	S-3
6-8	Sand, same as in S-3	SP	2.0/1.1	43.9	15-12-11-11	S-4
8-10	Overdrilled; pulled casing to repair. See log book.					
10-12	Sand, same as in S-4, but grey	SP	2.0/1.8	6.3	4-5-8-11	S-6
12-14	Sand, same as in S-6	SP	2.0/1.9	4	7-8-10-8	S-7
14-16	Sand, same as in S-7	SP	2.0/2.0	0.9	5-5-7-8	S-8
16-18	Silty sand, poorly graded, >12% fines, fine sand, saturated, grey	SM	2.0/1.8	0	10-7-8-9	S-9
18-20	Same as in S-9	SM	2.0/1.7	0	4-4-5-7	S-10
20-22	Same as in S-10	SM	2.0/2.0	0	6-5-7-8	S-11
22-24	Same as in S-11	SM	2.0/1.8	0	4-6-7-7	S-12
24-26	Same as in S-12	SM	2.0/2.0	0	5-9-10-14	S-13
26-28	Same as in S-13	SM	2.0/2.0	0	10-8-9-12	S-14
28-30	Same as in S-14, No changes since 14-16'	SM	2.0/2.0	0	5-5-7-7	S-15
30-32	Same as in S-15	SM	2.0/1.6	0	8-9-9-6	S-16
32-34	Same as in S-16	SM	2.0/1.8	0	8-10-10-11	S-17
34-36	Same as in S-17	SM	2.0/1.7	0	8-8-6-10	S-18
36-38	Sand, poorly graded, <5% fines, fine grained, saturated, medium dense, grey	SP	2.0/2.0	0	11-13-15-19	S-19
38-40	Sand, same as in S-19	SP	2.0/1.0	0	4-4-6-8	S-20
40-42	Sand, same as in S-20	SP	2.0/1.9	0	4-5-6-8	S-21
42-44	Sand, same as in S-21	SP	2.0/2.0	0	5-5-11-14	S-22
44-46	Sand, same as in S-22	SP	2.0/1.8	0	5-7-11-7	S-23
46-48	Sand, same as in S-23	SP	2.0/2.0	0	7-8-10-15	S-24
48-50	Sand, same as in S-24	SP	2.0/1.7	0	10-10-5-12	S-25
50-52	Sand, same as in S-25	SP	2.0/1.8	0	8-8-10-8	S-26
52-54	Sand, same as in S-26	SP	2.0/2.0	0	7-9-11-9	S-27
54-56	Sand, same as in S-27	SP	2.0/2.0	0	12-10-9-8	S-28



## Soil Boring Log

Harding Lawson Associates  
107 Audubon Road  
Wakefield, MA

Boring Location: **SB99-2**

Project Name: Riverside Mills

HLA Geologist: M. Phane

Date Started: 11/10/99

Drilling Company: GeoLogic

Date Completed: 11/10/99

Drilling Method: 4.25-in. HSAs

Total Depth: 20 ft.

Depth to Water: ~ 7 ft.

Comments:

Depth (feet)	Stratigraphy Description	USCS Class.	Penetration/ Recovery (feet)	Headspace (ppm)	Blows/ 6 inches	Sample IDs
0-2	Dry cement, white, crushed powder.	N/A	1.1 / 1.0	NA	60-120/5"- 12/1"-120/2"	S-1
2-4	Silty sand, moderately graded, 5% gravel to 0.2" max. (subrounded), >12% fines, loose, wet, dark brown, fine laminations of white ash.	SM	2.0 / 1.1	6.6	4-2-6-9	S-2
4-6	Sand, poorly graded, <5% fines, fine sand, wet, tan, some subrounded gravel at 5.8', to 1" max.	SP	2.0 / 1.8	7.2	10-17-29-33	S-3
6-8	Gravelly sand, well graded, 15% gravel to 0.5" max., medium sand, <5% fines, saturated at ~ 7', yellowish tan.	SW	2.0 / 1.5	56.1	31-27-30-37	S-4
8-10	Gravelly sand, similar to S-4, but with sheen and strong odor.	SW	2.0 / 1.3	396	31-33-44-29	S-5
10-12	Silty sand, poorly graded, >12% fines, loose, saturated, gray.	SM	2.0 / 1.5	106	5-3-6-7	S-6
12-14	Silty sand, similar to S-6.	SM	2.0 / 1.8	13.9	5-6-6-8	S-7
14-16	Silty sand, similar to S-6.	SM	2.0 / 1.6	3.3	2-3-6-6	S-8
16-18	Silty sand, similar to S-6.	SM	2.0 / 2.0	1.6	5-6-5-8	S-9
18-20	Silty sand, similar to S-6.	SM	Not recorded	1.7	5-3-4-5	S-10



## Soil Boring Log

Harding Lawson Associates  
107 Audubon Road  
Wakefield, MA

Boring Location: **SB99-3**

Project Name: Riverside Mills

HLA Geologist: M. Phaneuf

Date Started: 11/9/99

Drilling Company: GeoLogic

Date Completed: 11/9/99

Drilling Method: 4.25-in. HSAs

Total Depth: 16 ft.

Depth to Water: ~ 8.8 ft.

Comments: Encountered running sands at 16 feet.

Depth (feet)	Stratigraphy Description	USCS Class.	Penetration/ Recovery (feet)	Headspace (ppm)	Blows/ 6 inches	Sample IDs
0-2	Crushed red brick with angular rock fragments and subrounded pebbles, fill material, fine sand, dark brown, loose, dry	Fill	2.0/0.5	0	3-2-3-6	S-1
2-4	Gravelly sand, well graded, 10-15% gravel to 0.2" maximum, medium sand, <5% fines, damp, medium dense	Fill	2.0/1.0	16.6	8-7-4-8	S-2
-----Augered to 5 feet-----						
5-7	Gravelly sand, well graded, 15% gravel to 0.4" maximum, medium sand, <5% fines, dense, damp, yellowish tan with trace iron staining (native soil)	SW	2.0/1.0	2	11-19-26-31	S-3
7-9	Gravelly sand, similar to S-3	SW	2.0/1.0	295	12-20-22-33	S-4
-----Augered to 10 feet-----						
10-12	Silty sand, poorly graded, >12% fines, saturated, medium dense, grey, fine laminations (biotite?)	SM	2.0/2.0	92.1	7-8-8-7	S-5
12-14	Same as in S-5; saturated	SM	2.0/2.0	32.3	28-23-17-24	S-6
14-16	Top 6" blow in from running sands, then same as in S-5	SM	2.0/2.0	3.9	5-4-4-12	S-7
16-18	Hole is filled in to 9 ft. with running sands	N/A	0.0/0.0	N/A	N/A	N/A



## Soil Boring Log

Harding Lawson Associates  
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Wakefield, MA

Boring Location: **SB99-4**

Project Name: Riverside Mills

HLA Geologist: M. Phaneuf

Date Started: 11/12/99

Drilling Company: GeoLogic

Date Completed: 11/12/99

Drilling Method: 4.25-in. HSAs

Total Depth: 20 ft.

Depth to Water: ~ 10 ft.

### Comments:

Depth (feet)	Stratigraphy Description	USCS Class.	Penetration/ Recovery (feet)	Headspace (ppm)	Blows/ 6 inches	Sample IDs
0-2	Crushed red brick fragments, rock, small gravel and medium sand, dry, dark brown, building debris.	N/A	2.0/1.1	0	5-9-14-40	S-1
2-4	Black, very fissile shale, highly weathered. Minor amounts of brick and fill, some medium sands. Dry.	N/A	2.0/0.8	31.7	28-19-16-49	S-2
4-4	Spoon refusal. Auger to 5 ft. bgs	N/A	0/0	N/A	120/0"	S-3
5-5.6	Shale material, similar to S-2.	N/A	0.6/0.1	N/A	33-100/1"	S-4
-----Augered through rock from 5.6-8 feet-----						
8-10	Gravelly sand, well graded, 15% gravel to 0.3" maximum, medium sand, <5% fines, saturated, grey, strong odor and oil-like material at tip	SW	2.0/0.9	412	29-25-27-33	S-5
10-12	Sand, poorly graded, fine grained, medium dense, saturated, greyish green	SP	2.0/1.0	11.1	19-8-4-9	S-6
12-14	Sand, same as in S-6, with biotite	SP	2.0/1.7	6	6-6-8-6	S-7
14-16	Sand, same as in S-7, with thin bands of iron staining at 15.5 ft. bgs.	SP	2.0/1.5	1.7	7-9-12-16	S-8
16-18	Sand, same as in S-8, with iron banding throughout interval	SP	2.0/1.9	1.9	8-10-11-9	S-9
18-20	Sand, same as in S-9	SP	2.0/1.9	0	6-8-12-12	S-10



## Soil Boring Log

Harding Lawson Associates  
107 Audubon Road  
Wakefield, MA

Boring Location: **SB99-5**

Project Name: Riverside Mills

HLA Geologist: M. Phaneuf

Date Started: 11/12/99

Drilling Company: GeoLogic

Date Completed: 11/12/99

Drilling Method: 4.25-in. HSAs

Total Depth: 20 ft.

Depth to Water: ~ 10 ft.

Comments:

Depth (feet)	Stratigraphy Description	USCS Class.	Penetration/ Recovery (feet)	Headspace (ppm)	Blows/ 6 inches	Sample IDs
0-1.8	Crushed red brick, minor amounts of gravel and medium sand	N/A	1.8/0.7	0	7-3-29-100/3"	S-1
Augered through debris to 4 feet						
4-6	Gravelly sand, well graded, 15% gravel to 0.7" maximum, medium sand, <5% fines, damp, tan, strong odor	SW	2.0/1.5	69	19-18-17-15	S-2
6-8	Same gravelly sand as above (S-2), wet at 7.8 feet bgs	SW	2.0/1.0	391	11-14-17-21	S-3
8-10	Same gravelly sand as above, but saturated and grey	SW	2.0/2.0	469	18-25-27-23	S-4
10-12	Silty sand, poorly graded, >12% fines, fine sand, saturated, greyish green, slight odor	SM	2.0/1.5	29	7-8-7-9	S-5
12-14	Sand, poorly graded, fine grained, medium dense, saturated, grey to green	SP	2.0/2.0	6.5	9-8-8-8	S-6
14-16	Same as in S-6	SP	2.0/1.9	1.1	17-14-9-9	S-7
16-18	Same as in S-7	SP	not recorded	1.3	8-10-13-19	S-8
18-20	Same as in S-8	SP	not recorded	1	6-6-8-11	S-9

**Boring Location: SB99-6****Project Name:** Riverside Mills**HLA Geologist:** M. Phaneuf**Date Started:** 11/15/99**Drilling Company:** GeoLogic**Date Completed:** 11/15/99**Drilling Method:** 4.25-in. HSAs**Total Depth:** 20 ft.**Depth to Water:** ~ 9 ft**Comments:****Soil Boring Log**Harding Lawson Associates  
107 Audubon Road  
Wakefield, MA

Depth (feet)	Stratigraphy Description	USCS Class.	Penetration/ Recovery (feet)	Headspace (ppm)	Blows/ 6 inches	Sample IDs
0-2	Gravelly sand, well graded, 15% gravel to 0.4" maximum, medium sand, <5% fines, damp, dark brown	SW	2.0/0.3	0	8-74-33-21	S-1
2-4	Similar to above in S-1, with thin layer of crushed grey shale at spoon tip.	SW	2.0/0.5	0	19-10-8-8	S-2
4-6	Gravelly sand, well graded, 15% gravel to 0.6" maximum, medium sand, <5% fines, damp, tan	SW	2.0/1.1	0	5-5-11-18	S-3
6-8	Same as above in S-3, wet at spoon tip	SW	2.0/1.0	0	12-20-14-17	S-4
8-10	Silty sand, poorly graded, >12% fines, fine sand, saturated at ~9ft, grey green	SM	2.0/0.9	0	25-20-12-8	S-5
10-12	Same as in S-5	SM	2.0/0.3	0	33-18-13-15	S-6
12-14	Same as in S-6	SM	2.0/2.0	0	5-7-6-6	S-7
14-16	Same as in S-7, but tan with iron staining throughout interval	SM	2.0/1.8	0	7-10-13-15	S-8
16-18	Same as in S-8	SM	2.0/2.0	0	9-11-12-14	S-9
18-20	Same as in S-9	SM	2.0/2.0	0	4-8-10-8	S-10



## Soil Boring Log

Harding Lawson Associates  
107 Audubon Road  
Wakefield, MA

Boring Location: **SB99-7**

Project Name: Riverside Mills

HLA Geologist: M. Phaneuf

Date Started: 11/15/99

Drilling Company: GeoLogic

Date Completed: 11/15/99

Drilling Method: 4.25-in. HSAs

Total Depth: 20 ft.

Depth to Water: 9 ft.

Comments:

Depth (feet)	Stratigraphy Description	USCS Class.	Penetration/ Recovery (feet)	Headspace (ppm)	Blows/ 6 inches	Sample IDs
0.5-2	Sand, poorly graded, medium sand, <5% fines, dry, medium dense, tan, contains gravel at spoon tip	SP	1.5/1.0	0	6-7-14	S-1
2-4	Fill, gravel, red brick fragments, pieces of asphalt, damp	N/A	2.0/0.3	Not collected	8-8-7-9	S-2
4-6	Top 6": gravelly sand, well graded, 15% gravel to 1" maximum, dense, damp, tan. Then: white, broken concrete and cement powder	SW	2.0/1.6	0	4-17-57-119	S-3
6-8	Gravelly sand, as in S-3, but damp	SW	0.1/0.1	Not collected	120/1.5"	S-4
8-10	Silty sand, poorly graded. >12% fines, fine sand, saturated at 9 feet, grey	SM	2.0/1.1	0	7-6-6-5	S-5
10-12	Same as in S-5	SM	2.0/1.2	0	4-5-7-8	S-6
12-14	Same as in S-6	SM	2.0/1.8	0	5-8-10-12	S-7
14-16	Sand, poorly graded, <5% fines, fine sand, saturated, dense, grey	SP	2.0/2.0	0	10-17-13-18	S-8
16-18	Sand, same as in S-8, with iron staining throughout	SP	2.0/2.0	0	3-3-5-6	S-9
18-20	Same as in S-9	SP	2.0/2.0	0	8-10-10-8	S-10



## **APPENDIX C**

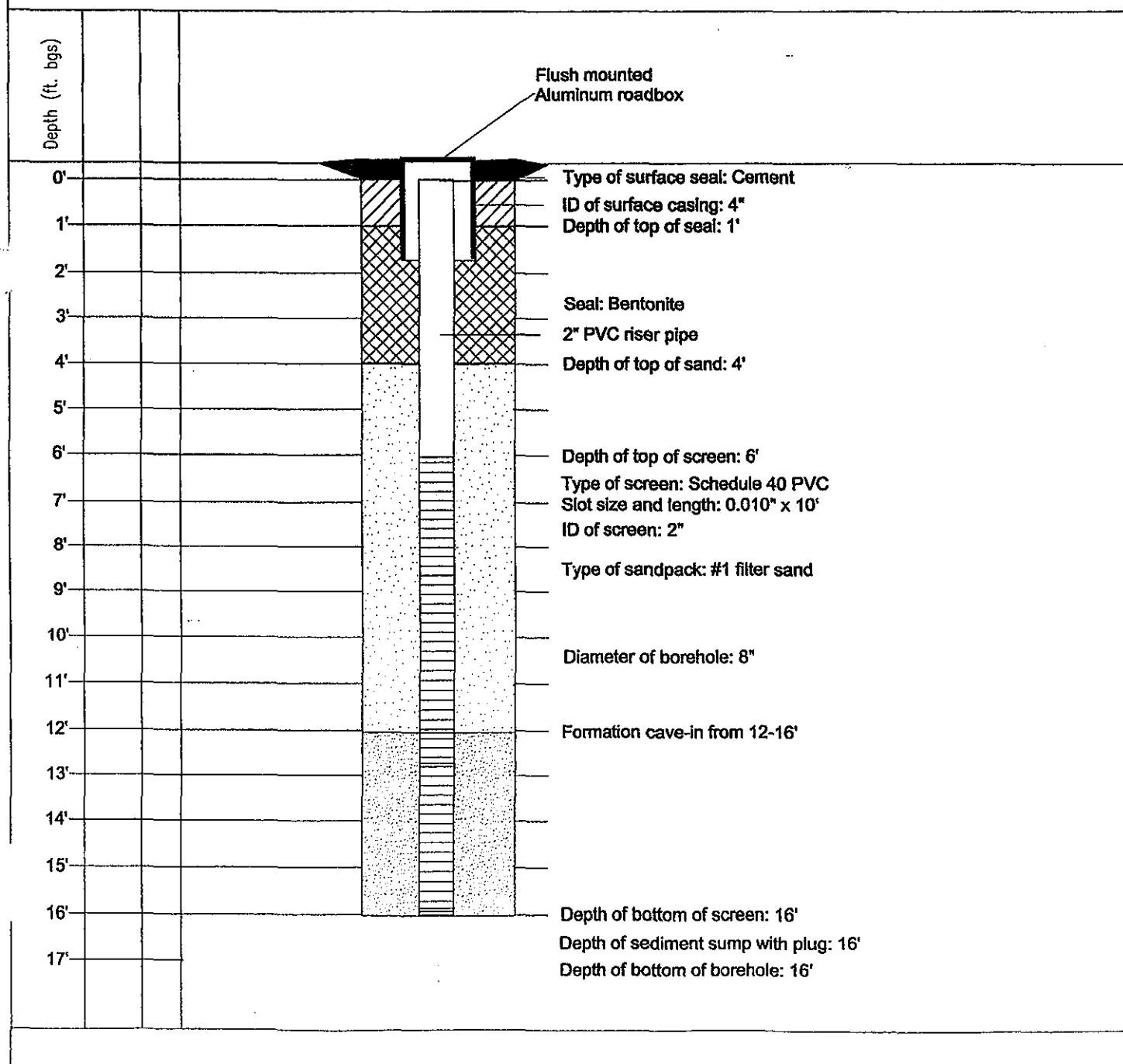
### **MONITORING WELL CONSTRUCTION DIAGRAMS**



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## MONITORING WELL DIAGRAM

WELL:	MW-99-5	DRILLING METHOD:	4.25" HSA
PROJECT NAME:	FORMER RIVERSIDE MILLS	DEVELOPMENT METHOD:	PUMP AND SURGE
PROJECT LOCATION:	PROVIDENCE, RI	FIELD GEOLOGIST:	MARK PHANEUF
PROJECT NUMBER:	48400.7		
CONTRACTOR:	JOHN GALVIN/ GEOLOGIC		
DATE INSTALLED:	11/10/99		

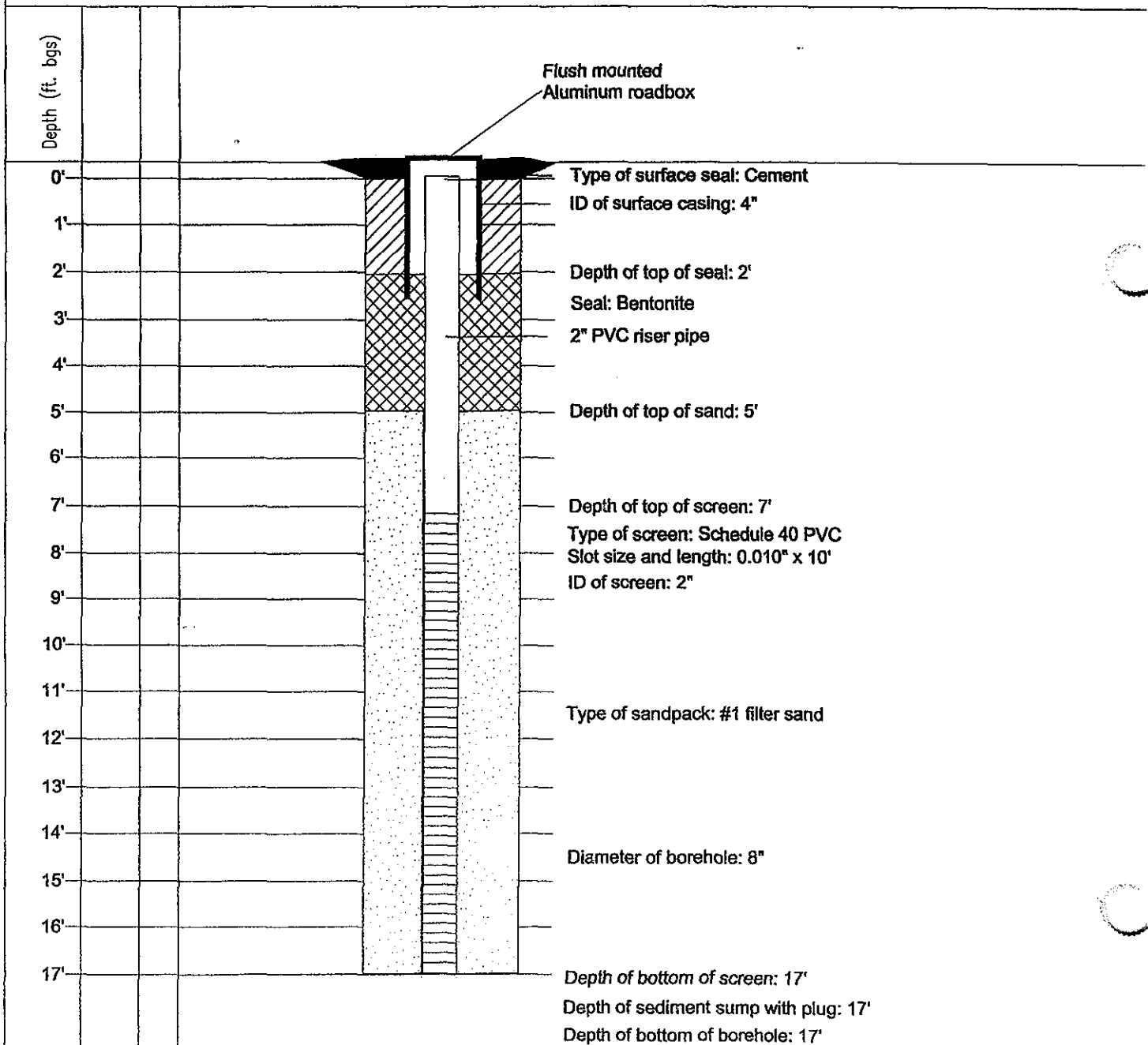




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## MONITORING WELL DIAGRAM

WELL:	MW-99-6	DRILLING METHOD:	4.25" HSA
PROJECT NAME:	FORMER RIVERSIDE MILLS	DEVELOPMENT METHOD:	PUMP AND SURGE
PROJECT LOCATION:	PROVIDENCE, RI	FIELD GEOLOGIST:	MARK PHANEUF
PROJECT NUMBER:	48400.7		
CONTRACTOR:	JOHN GALVIN/GEOLOGIC		
DATE INSTALLED:	11/12/99		

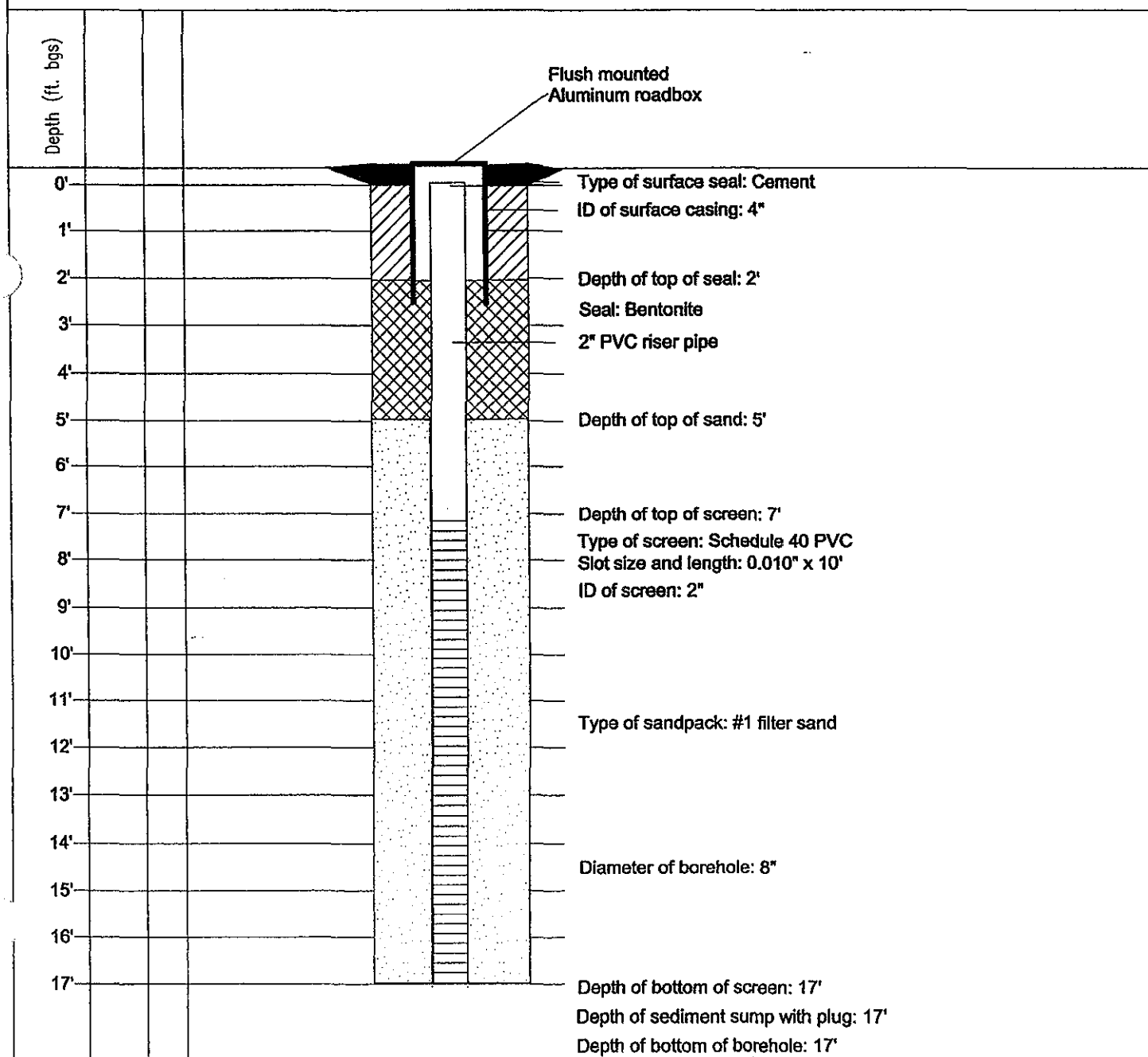




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## MONITORING WELL DIAGRAM

WELL:	MW-99-7	DRILLING METHOD:	4.25" HSA
PROJECT NAME:	FORMER RIVERSIDE MILLS	DEVELOPMENT METHOD:	PUMP AND SURGE
PROJECT LOCATION:	PROVIDENCE, RI	FIELD GEOLOGIST:	MARK PHANEUF
PROJECT NUMBER:	48400.7		
CONTRACTOR:	JOHN GALVIN/GEOLOGIC		
DATE INSTALLED:	11/12/99		

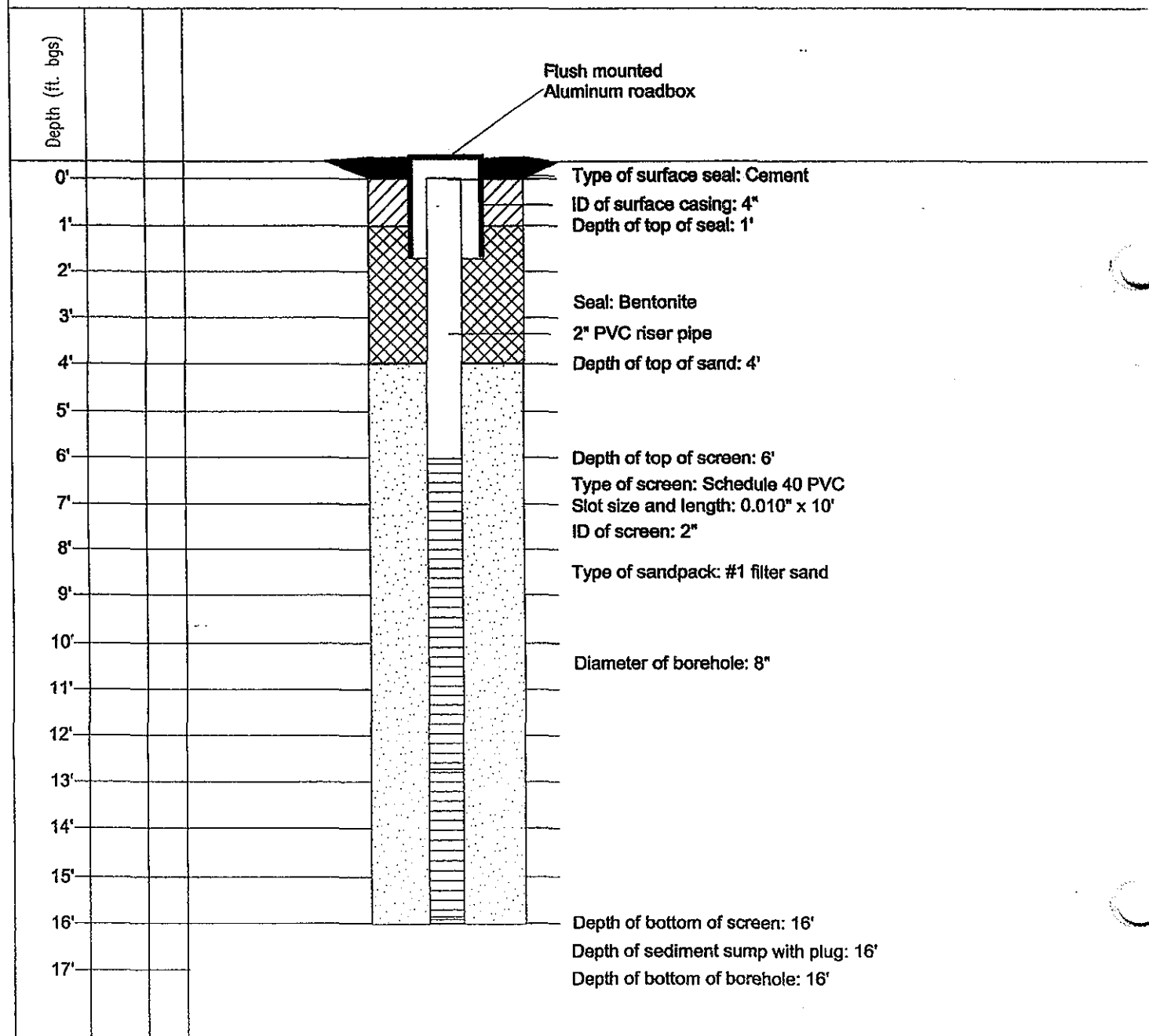




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## MONITORING WELL DIAGRAM

WELL:	MW-99-8	DRILLING METHOD:	4.25" HSA
PROJECT NAME:	FORMER RIVERSIDE MILLS	DEVELOPMENT METHOD:	PUMP AND SURGE
PROJECT LOCATION:	PROVIDENCE, RI	FIELD GEOLOGIST:	MARK PHANEUF
PROJECT NUMBER:	48400.7		
CONTRACTOR:	JOHN GALVIN/GEOLOGIC		
DATE INSTALLED:	11/15/99		



**APPENDIX D**  
**WELL DEVELOPMENT RECORDS**

# MONITORING WELL DEVELOPMENT RECORD

Project: <b>Former Riverside</b>	Well Installation Date: <b>11/16/99</b>	Project No. <b>48400-4</b>
Client:	Well Development Date: <b>11/16/99</b>	Logged by: <b>MP: KW</b>
Well/Site I.D.: <b>MW-1</b>	Weather: <b>Sunny 33° breezy</b>	Start Date: <b>11/16/99</b>
Volume of Drilling Fluid Lost (gal.): <b>—</b>	Volume of Water in Well and Filter Pack (gal.): <b>—</b>	Finish Date: <b>11/16/99</b>
	Start Time: <b>0845</b>	Finish Time: <b>1025</b>

Installed Depth From Top of Well Casing to Bottom of Well:

Initial Depth to Water (ft.) **8.83 BTOR** Initial Depth to Well Bottom: **13.76 BTOR**

Water Level during Initial Pumping/Purging (ft):

Water Level at Termination of Pumping/Purging (ft): **8.98** Depth to well Bottom at termination of Pumping/Purging (ft.): **13.99**

Well Depth **13.99 OTB (Rem PVL)** Well Mouth PID = **8.2 ppm**

Static Water height \_\_\_\_\_

Static Water Volume \_\_\_\_\_  
(V=h(0.16) gallons for 2" well)

**Redox (mV):** **-49.9 -47.3 -50.5 -52.4 -59.0**

PARAMETER	INITIAL READING	VOLUME 1	VOLUME 2	VOLUME 3	VOLUME 4	VOLUME 5	
<b>mS/cm</b>		<b>~30gal</b>	<b>~40gal</b>	<b>~60gal</b>	<b>~80gal</b>	<b>~90gal</b>	<b>~100gal</b>
CONDUCTIVITY ( $\mu S/cm$ )	<b>1.29</b>	<b>1.35</b>	<b>1.34</b>	<b>1.33</b>	<b>1.32</b>	<b>1.32</b>	<b>1.31</b>
pH (STANDARD UNITS)	<b>6.14</b>	<b>6.26</b>	<b>6.22</b>	<b>6.21</b>	<b>6.21</b>	<b>6.22</b>	<b>6.22</b>
TEMPERATURE (C)	<b>11.8</b>	<b>13.8</b>	<b>14.0</b>	<b>14.0</b>	<b>14.2</b>	<b>14.2</b>	<b>14.2</b>
TURBIDITY (NTUs)	<b>&gt;999</b>	<b>111</b>	<b>158</b>	<b>200</b>	<b>330</b>	<b>330</b>	<b>230</b>
APPROX. PUMPING RATE (GPM)	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>	<b>1.8</b>
<b>D.O.</b>	<b>0.57</b>	<b>1.88</b>	<b>0.54</b>	<b>0.44</b>	<b>0.54</b>	<b>0.43</b>	<b>0.33</b>

Well Developer's Signature

**Volume** **110 120 130 150 160 170 180 gallons**

**Redox** **-52.6 -53.0 -51.6**

**Cond.** **1.31 1.29 1.24**

**pH** **6.24 6.21 6.20**



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**Temp** **14.0 14.3 14.2**

**Turb.** **120 104 270 270 220 260 240**

**GPM** **1.8 1.8 1.8**

**D.O.** **0.53 0.33 0.43**

# MONITORING WELL DEVELOPMENT RECORD

Project: <b>FORMER RIVERSIDE MILLS</b>	Well Installation Date: <b>11/16/99</b>	Project No. <b>48400-4</b>
Client:	Well Development Date: <b>11/16/99</b>	Logged by: <b>HRW</b>
Well/Site I.D.: <b>MW-2</b>	Weather: <b>30-40s BREEZY</b>	Start Date: <b>11/16/99</b>
Volume of Drilling Fluid Lost (gal.)	Volume of Water in Well and Filter Pack (gal.)	Finish Date: <b>11/16/99</b>
		Start Time: <b>1215 hrs</b>
		Finish Time: <b>1330</b>

Installed Depth From Top of Well Casing to Bottom of Well:

Initial Depth to Water (ft.) **6.11** Initial Depth to Well Bottom: **13.68**

Water Level during Initial Pumping/Purging (ft):

Water Level at Termination of Pumping/Purging (ft): **6.15** Depth to well Bottom at termination of Pumping/Purging (ft.): **14.30**

Well Depth \_\_\_\_\_

Static Water height \_\_\_\_\_

Static Water Volume \_\_\_\_\_  
(V=h(0.16) gallons for 2" well)

PID @ well mouth = **2.8 ppm**

Note: Well will purge dry, used Control Box to slow rate down to 0.5 gpm

Redox (mv) **-13.5 -24.1 -21.2**

PARAMETER	INITIAL READING	VOLUME 1	VOLUME 2	VOLUME 3	VOLUME 4	VOLUME 5
<b>GAL.</b>		<b>15</b>	<b>21</b>	<b>25</b>		
CONDUCTIVITY (M / cm) mS/cm	<b>0.627</b>	<b>0.702</b>	<b>0.698</b>	<b>0.703</b>		
pH (STANDARD UNITS)	<b>6.03</b>	<b>6.04</b>	<b>6.05</b>	<b>6.03</b>		
TEMPERATURE (C)	<b>12.6</b>	<b>13.2</b>	<b>13.5</b>	<b>13.2</b>		
TURBIDITY (NTUs)	<b>8.627</b>	<b>0</b>	<b>0</b>	<b>0</b>		
APPROX. PUMPING RATE (GPM)	<b>Purged dry</b>	<b>0.5 gpm</b>	<b>0.5 gpm</b>	<b>0.5 gpm</b>		

D.O. mg/L **2.9 2.7 mg/L 2.7 mg/L 2.7 mg/L**

Well Developer's Signature \_\_\_\_\_



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# MONITORING WELL DEVELOPMENT RECORD

Project: <b>FORMER RIVERSIDE MILLS</b>	Well Installation Date:	Project No. <b>48400-4</b>
Client:	Well Development Date: <b>11/16/99</b>	Logged by: <b>MP:KW</b>
Well/Site I.D.: <b>MW-3</b>	Weather: <b>Sunny, 38° breezy</b>	Start Date: <b>11/16/99</b>
Volume of Drilling Fluid Lost (gal.):	Volume of Water in Well and Filter Pack (gal.):	Finish Date: <b>11/16/99</b>
		Start Time: <b>11:07</b>
		Finish Time: <b>12:00</b>

Installed Depth From Top of Well Casing to Bottom of Well:

Initial Depth to Water (ft.) <b>6.61</b>	Initial Depth to Well Bottom: <b>12.98</b>
---	---

Water Level during Initial Pumping/Purging (ft):

Water Level at Termination of Pumping/Purging (ft): <b>6.78</b>	Depth to well Bottom at termination of Pumping/Purging (ft.): <b>14.10</b>
--	---

Well Depth \_\_\_\_\_

PID Well Mouth = 4.4 ppm

Static Water height \_\_\_\_\_

Static Water Volume \_\_\_\_\_  
(V=h(0.16) gallons for 2" well)

*Redox (mv):*      37.5      56.2      49.5      53.2      50.1      57.9

PARAMETER	INITIAL READING	VOLUME 1 20 gal	VOLUME 2 40 gal	VOLUME 3 50	VOLUME 4 60 gal	VOLUME 5 80 gal
CONDUCTIVITY (M / cm) <i>MS/cm</i>	0.645	0.595	0.545	0.555	0.612	0.618
pH (STANDARD UNITS)	6.04	5.95	6.04	5.95	5.95	6.01
TEMPERATURE (C)	12.2	12.9	12.1	13.2	13.3	13.4
TURBIDITY (NTUs)	700	72	9	0	0	0
APPROX. PUMPING RATE (GPM)	1.8	1.8	1.8	1.8	1.8	1.8

*P.O.*      0.71      0.68      0.79      0.90      0.97      0.76

Well Developer's Signature \_\_\_\_\_



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# MONITORING WELL DEVELOPMENT RECORD

Project: <b>FORMER RIVERSIDE MILLS</b>	Well Installation Date: <b>11/10/99</b>	Project No. <b>48900-4</b>
Client:	Well Development Date: <b>11/16/99</b>	Logged by: <b>MP: KW</b>
Well/Site I.D.: <b>MW 99-5</b>	Weather: <b>P. Cloudy 38°; Windy</b>	Start Date: <b>11/16/99</b>
Volume of Drilling Fluid Lost (gal.) <b>40 gal.</b>	Volume of Water in Well and Filter Pack (gal.)	Finish Date: <b>11/16/99</b>
		Start Time: <b>1335</b>
		Finish Time: <b>1451</b>

Installed Depth From Top of Well Casing to Bottom of Well:

Initial Depth to Water (ft) **6.78** Initial Depth to Well Bottom: **13.99**

Water Level during Initial Pumping/Purging (ft):

Water Level at Termination of Pumping/Purging (ft): **6.81** Depth to well Bottom at termination of Pumping/Purging (ft.): **15.31**

Well Depth \_\_\_\_\_

Static Water height \_\_\_\_\_

Static Water Volume \_\_\_\_\_  
(V=h(0.16) gallons for 2" well)

MAX FLOW RATE 0.3 GPM

16.5 ppm Headspace on H<sub>2</sub>O

Redox (mV) -35.5 -68.4 -80.8 -85.3 -82.0 -83.0 -82.4

PARAMETER	INITIAL READING	VOLUME 1	VOLUME 2	VOLUME 3	VOLUME 4	VOLUME 5
MS/cm	1.27	5 gal	6.5 gal	8.0 gal	9.5 gal	11 gal
CONDUCTIVITY (MS/cm)	1.18	1.18	1.23	1.21	1.21	1.20
pH (STANDARD UNITS)	6.40	6.42	6.41	6.43	6.43	6.42
TEMPERATURE (C)	11.6	12.5	12.7	12.9	12.6	12.5
TURBIDITY (NTUs)	42	115	65	50	39	23
APPROX. PUMPING RATE (GPM)	0.3	0.3	0.3	0.3	0.3	0.3

D.O. mg/L 2.10 1.09 1.05 1.25 1.34 1.23 1.46

Well Developer's Signature

*[Signature]*

OTW=11'

\* Note: ON 11/17/99 Returned & Surged well

More @ high rate (1.9 gpm). Well would dry up, HLA allowed Recharge, then purge & pump again.



Containerizing of a total of 55 gallons from this well during Development

# MONITORING WELL DEVELOPMENT RECORD

Project: <b>FORMER RIVERSIDE</b>	Well Installation Date: <b>11/12/99</b>	Project No. <b>48900-A</b>
Client:	Well Development Date: <b>11/17/99</b>	Logged by: <b>MJP</b>
Well/Site I.D.: <b>MW-99-6</b>	Weather: <b>Sunny, 45° windy</b>	Start Date: <b>11/17/99</b>
Volume of Drilling Fluid Lost (gal.) <b>0</b>	Volume of Water in Well and Filter Pack (gal.)	Finish Date: <b>11/17/99</b>
		Start Time: <b>1230</b>
		Finish Time:

Installed Depth From Top of Well Casing to Bottom of Well:

Initial Depth to Water (ft.) **9.09** Initial Depth to Well Bottom: **15.64**

Water Level during Initial Pumping/Purging (ft.): **16.85 MJP**

Water Level at Termination of Pumping/Purging (ft.): **9.50** Depth to well Bottom at termination of Pumping/Purging (ft.): **16.85**

Well Depth \_\_\_\_\_

Static Water height \_\_\_\_\_

Static Water Volume \_\_\_\_\_  
(V=h(0.16) gallons for 2" well)

Water has sheen and strong odor.

Redox mV -4.5 -12.7 -75.9 -79.1 -81.6 -82.5

PARAMETER	INITIAL READING	VOLUME 1	VOLUME 2	VOLUME 3	VOLUME 4	VOLUME 5
		25.11	28	31	34	37
CONDUCTIVITY (µS/cm)	0.600	0.562	0.526	0.554	0.566	0.566
pH (STANDARD UNITS)	6.30	6.13	6.42	6.48	6.47	6.43
TEMPERATURE (C)	13.9	14.1	14.0	13.9	13.9	13.7
TURBIDITY (NTUs)	871	55	13	3	1	0
APPROX. PUMPING RATE (GPM)	N/A	0.5	0.5	0.5	0.5	0.5

D.O. ~~0.97~~ 0.97 mg/L 0.51 0.51 0.44 0.96 0.71

(MJP)

Well Developer's Signature

*[Signature]*

# MONITORING WELL DEVELOPMENT RECORD

Project: Former Riverside Mills

Well Installation Date: 11/12/99

Project No. 48400-4

Client:

Well Development Date: 11/17/99

Logged by: MP

Checked by:

Well/Site I.D.: MW 99-7

Weather: Windy, 39° Sunny

Start Date: 11/17/99

Finish Date: 11/17/99

Volume of Drilling Fluid Lost (gal.)

Volume of Water in Well and Filter Pack (gal.)

Start Time: 0800

Finish Time: 0944

Installed Depth From Top of Well Casing to Bottom of Well:

Initial Depth to Water (ft.) 8.45'

Initial Depth to Well Bottom: 15.55

Water Level during Initial Pumping/Purging (ft):

Water Level at Termination of Pumping/Purging (ft): 8.60'

Depth to well Bottom at termination of Pumping/Purging (ft.) 17.00'

Well Depth \_\_\_\_\_

Static Water height \_\_\_\_\_

Static Water Volume \_\_\_\_\_  
( $V=h(0.16)$  gallons for 2" well)

Redox mv 69 31.7 4.3 -20.1 -29 -26.5 -40.3 -41.

PARAMETER	INITIAL READING	VOLUME 1	VOLUME 2	VOLUME 3	VOLUME 4	VOLUME 5
		<u>20 gal</u>	<u>30 gal</u>	<u>40 gal</u>	<u>75 gal</u>	<u>85 gal</u>
CONDUCTIVITY (M / cm) ms/cm	<u>1664</u>	<u>0.615</u>	<u>0.613</u>	<u>0.613</u>	<u>0.605</u>	<u>0.613</u> <u>0.535</u>
pH (STANDARD UNITS)	<u>6.15</u>	<u>6.33</u>	<u>6.24</u>	<u>6.24</u>	<u>6.24</u>	<u>6.27</u>
TEMPERATURE (C)	<u>10.1</u>	<u>12.4</u>	<u>13.0</u>	<u>12.9</u>	<u>12.9</u>	<u>12.9</u>
TURBIDITY (NTUs)	<u>71000</u>	<u>190</u>	<u>115</u>	<u>82</u>	<u>166</u>	<u>95</u> <u>46</u>
APPROX. PUMPING RATE (GPM)	<u>1.1</u>	<u>1.2</u>	<u>1.2</u>	<u>1.2</u>	<u>1.2</u>	<u>1.2</u>

D.O. mg/L 1.45 2.12 1.91 1.17 1.42 0.87 0.96 1.1

Well Developer's Signature

[Signature]

DTW: 13' 11.8' 12.95' 14.74'



HARDING LAWSON ASSOCIATES

# MONITORING WELL DEVELOPMENT RECORD

Project: <b>FORMER RIVERSIDE MILLS</b>	Well Installation Date: <b>11/15/99</b>	Project No. <b>48400-4</b>	
Client:	Well Development Date: <b>11/17/99</b>	Logged by: <b>MJP</b>	Checked by:
Well/Site I.D.: <b>MW-99 8</b>	Weather: <b>Sunny, 40° breezy</b>	Start Date: <b>11/17/99</b>	Finish Date: <b>11/17/99</b>
Volume of Drilling Fluid Lost (gal.):	Volume of Water in Well and Filter Pack (gal.):	Start Time: <b>1010</b>	Finish Time: <b>1130</b>

Installed Depth From Top of Well Casing to Bottom of Well:

Initial Depth to Water (ft.) <b>7.91</b>	Initial Depth to Well Bottom: <b>14.41</b>
---	---

Water Level during Initial Pumping/Purging (ft):

Water Level at Termination of Pumping/Purging (ft): <b>8.56</b>	Depth to well Bottom at termination of Pumping/Purging (ft.): <b>15.99</b>
--	---

Well Depth \_\_\_\_\_

Static Water height \_\_\_\_\_

Static Water Volume \_\_\_\_\_  
(V=h(0.16) gallons for 2" well)

Redox mV      **40.5**      **27.8**      **21.1**

PARAMETER	INITIAL READING	VOLUME 1	VOLUME 2	VOLUME 3	VOLUME 4	VOLUME 5
	<b>17 gal/hr</b>	<b>21</b>	<b>25</b>			
CONDUCTIVITY (µM / cm) <b>mS/cm</b>	<b>0.463</b>	<b>0.461</b>	<b>0.461</b>			
pH (STANDARD UNITS)	<b>6.17</b>	<b>6.23</b>	<b>6.18</b>			
TEMPERATURE (C)	<b>13.8</b>	<b>14.1</b>	<b>14.2</b>			
TURBIDITY (NTUs)	<b>22</b>	<b>18</b>	<b>4</b>			
APPROX. PUMPING RATE (GPM)	<b>0.45</b>	<b>0.45</b>	<b>0.45</b>			

D.O. mg/L      **2.67**      **2.60**      **2.49**

Well Developer's Signature \_\_\_\_\_



**APPENDIX E**  
**WATER LEVEL DATA SHEET**

# WATER LEVEL DATA SHEET

PERSONNEL: MP: J. J.

SHEET # 1 OF 1

WEATHER: 35°, P. cloudy, cal m.

ROUND# 1 TIME 0755

DATE: 11/18/99

LOCATION: RIVERSIDE

CLIENT: \_\_\_\_\_

JOB NUMBER: 48400-4

[illegible]

HARTING LAWSON ASSOCIATES

**APPENDIX F**

**LOW FLOW GROUNDWATER SAMPLING FORMS**





PROJECT FORMER RIVERSIDE MILLS BROWNFIELDS SITE SAMPLE I.D. NUMBER RM6W02XX01XX ROUND NO. 1

SAMPLE LOCATION: MW-2 SITE TYPE NA DATE 11/19/99

TIME START 1005 END 1058 JOB NUMBER 48400.4 FILE TYPE NA

PROTECTIVE  
CASING / WELL  
DIFFERENCE

WELL DIAMETER	2 IN
------------------	------

WELL -	YES	NO	N/A
INTEGRITY: CAP	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

CASING	✓	—	—
LOCKED	—	—	✓
COLLAR	✓	—	—

DISCHARGE  
TIMER  
SETTING

[illegible]

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
<input type="checkbox"/> QED BLADDER	<input type="checkbox"/> TEFLON OR TEFLON LINED	<input type="checkbox"/> POLYVINYL CHLORIDE	<input type="checkbox"/> TEFLON <b>DNA</b>
<input type="checkbox"/> SIMCO BLADDER	<input type="checkbox"/> HIGH DENSITY POLYETHYLENE	<input type="checkbox"/> STAINLESS STEEL	<input type="checkbox"/> OTHER _____
<input checked="" type="checkbox"/> OTHER <b>Wheal</b>	<input checked="" type="checkbox"/> OTHER <b>PVC</b>	<input checked="" type="checkbox"/> OTHER <b>Wheal pump delivery</b>	

used to Ground

Sample Time: 10:40

SIGNATURE: \_\_\_\_\_

Harding Lawson Associates

PROJECT	FORMER RIVERSIDE MILLS BROWNFIELDS SITE	SAMPLE I.D. NUMBER	RM GW 03 XX 01 XX	ROUND NO.	1
SAMPLE LOCATION:	MW-3	SITE TYPE	NA	DATE	11/18/99
START	0845	END	0930	JOB NUMBER	48400.4
				FILE TYPE	NA

PURGE DATA										PUMP INTAKE DEPTH (ft)	COMMENTS
TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	CONDUCTANCE (umho/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)			
0857	6.70	380	9.9	0.444	5.81	1.70	14	170.1	13'		
0905	6.71	380	11.8	0.422	6.01	0.48	2	117.6	"		
0911	6.71		12.3	0.389	6.08	0.41	5-30	114.7	"		
0916	6.71		12.3	0.417	6.10	0.34	2-30	115.9	"		
0920	6.71		13.0	0.376	6.09	0.31	2-30	119.7	"		
0925	6.72		13.1	0.388	6.09	0.32	0	123.0	"		
0930	6.75	500	13.3	0.413	6.08	0.12	0	122.0	"		
		+ 2 Purge to sampling									

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
<input type="checkbox"/> QED BLADDER	<input type="checkbox"/> TEFLON OR TEFLON LINED	<input type="checkbox"/> POLYVINYL CHLORIDE	<input type="checkbox"/> TEFLON
<input type="checkbox"/> SIMCO BLADDER	<input type="checkbox"/> HIGH DENSITY POLYETHYLENE	<input type="checkbox"/> STAINLESS STEEL	<input type="checkbox"/> OTHER
<input checked="" type="checkbox"/> OTHER <u>whale</u>	<input checked="" type="checkbox"/> OTHER <u>PVC</u>	<input checked="" type="checkbox"/> OTHER <u>whale pump dedicated</u>	

To Be Collected	METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
<input checked="" type="checkbox"/> VOC	8260B	HCL / 4 DEG. C	2 X 40 mL	<input checked="" type="checkbox"/> VOC
<input checked="" type="checkbox"/> SVOC	CLP	4 DEG. C	2 X 1 L AG	<input checked="" type="checkbox"/> SVOC
<input checked="" type="checkbox"/> TPH -GRO	CLP	HCL / 4 DEG. C	2 X 40 mL	<input checked="" type="checkbox"/> TPH -GRO
<input checked="" type="checkbox"/> TPH-DRO	CLP	4 DEG. C	2 X 1 L AG	<input checked="" type="checkbox"/> TPH-DRO
<input type="checkbox"/>				<input type="checkbox"/>
<input type="checkbox"/>				<input type="checkbox"/>
<input type="checkbox"/>				<input type="checkbox"/>
<input type="checkbox"/>				<input type="checkbox"/>
<input type="checkbox"/>				<input type="checkbox"/>
<input type="checkbox"/>				<input type="checkbox"/>
<input type="checkbox"/>				<input type="checkbox"/>
<input type="checkbox"/> Other _____	_____	_____	_____	<input type="checkbox"/>
<input type="checkbox"/> Other _____	_____	_____	_____	<input type="checkbox"/>
<input type="checkbox"/> Other _____	_____	_____	_____	<input type="checkbox"/>

NOTES Sample Time: 935

Harding Lawson Associates

FIELD DATA RECORD - LOW FLOW GROUNDWATER SAMPLING

PROJECT FORMER RIVERSIDE MILLS BROWNFIELDS SITE SAMPLE I.D. NUMBER RMGW05XX01XX ROUND NO. 1  
SITE LOCATION: MW 99-5 SITE TYPE NA DATE 11/19/99  
START 810 END 1050 JOB NUMBER 48400.4 FILE TYPE NA

WATER LEVEL / PUMP SETTINGS  
MEASUREMENT POINT  
☒ TOP OF WELL RISER  
☐ TOP OF PROTECTIVE CASING  
☐ OTHER  
PROTECTIVE CASING STICKUP (FROM GROUND) Flush FT  
PROTECTIVE CASING / WELL DIFFERENCE -0.46 FT  
INITIAL DEPTH TO WATER 6.72 FT  
WELL DEPTH (TOR) 15.58 FT  
PID AMBIENT AIR 0 PPM  
WELL DIAMETER 2 IN  
FINAL DEPTH TO WATER 6.92 FT  
SCREEN LENGTH 10 FT  
PID WELL MOUTH 337 PPM  
WELL - INTEGRITY: CAP ☒ YES ☐ NO ☐ N/A  
CASING LOCKED ☒ YES ☐ NO ☒ N/A  
DRAWDOWN VOLUME 0.032 GAL  
RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED .004  
PRESSURE TO PUMP PSI  
DISCHARGE COLLAR ☒ YES ☐ NO ☒ N/A  
TOTAL VOL PURGED 8 GAL  
81m x 370 x .00026  
(purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)  
REFILL TIMER SETTING PSI  
DISCHARGE TIMER SETTING PSI

ack off low

PURGE DATA				SPECIFIC CONDUCTANCE				PUMP		COMMENTS
TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	CONDUCTANCE (umho/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	INTAKE DEPTH (ft)	
824	7.42	370	11.1	.442	5.83	2.26	41	148.5	13.5	
829	7.20		12.5	.490	6.07	0.55	597	129.9		
835	7.22		12.8	.505	6.16	0.48	886	124.9		
840	7.48		12.9	.509	6.25	0.61	603	128.5		
846	7.31		13.9	.512	6.27	0.88	490	128.6		
852	7.16		13.0	.511	6.28	0.91	508	128.5		
859	7.15		12.8	.510	6.30	1.22	531	132.9		Dumped probe container water to ren. silt
906	7.22		13.1	.505	6.27	1.44	201	137.5		
1	7.18		13.0	.503	6.25	1.44	184	139.1		
120	7.18		13.3	.504	6.26	1.31	100	137.5		Continue on pg 2

EQUIPMENT DOCUMENTATION  
TYPE OF PUMP  
☐ QED BLADDER  
☐ SIMCO BLADDER  
☒ OTHER Whale  
TYPE OF TUBING  
☐ TEFLON OR TEFLON LINED  
☐ HIGH DENSITY POLYETHYLENE  
☒ OTHER PVC  
TYPE OF PUMP MATERIAL  
☐ POLYVINYL CHLORIDE  
☐ STAINLESS STEEL  
☒ OTHER Whale pump dedicated  
TYPE OF BLADDER MATERIAL  
☒ TEFLON  
☐ OTHER DNA

ANALYTICAL PARAMETERS  
To Be Collected  
☒ VOC  
☒ SVOC  
☒ TPH-GRO  
☒ TPH-DRO  
☐ Other  
☐ Other  
☐ Other  
METHOD NUMBER  
8260B  
CLP  
CLP  
CLP  
PRESERVATION METHOD  
HCL / 4 DEG. C  
4 DEG. C  
HCL / 4 DEG. C  
4 DEG. C  
VOLUME REQUIRED  
2 X 40 mL  
2 X 1 LAG  
2 X 40 mL  
2 X 1 LAG  
SAMPLE COLLECTED  
☒ VOC  
☒ SVOC  
☒ TPH-GRO  
☒ TPH-DRO  
☐ Other  
☐ Other  
☐ Other

PURGE OBSERVATIONS  
PURGE WATER CONTAINERIZED ☒ YES ☐ NO  
NUMBER OF GALLONS GENERATED 8  
LOCATION SKETCH  
Note: Slight silt noted in collection bucket water extracted from well

NOTES  
Hidden Sample Collected 955  
Duplicate Sample Collected on this well  
RMGW09XX01XX Collected @  
made up time of 1030  
SIGNATURE: RD Jacob  
Harding Lawson Associates

## FIELD DATA RECORD - LOW FLOW GROUNDWATER SAMPLING

PROJECT FORMER RIVERSIDE MILLS BROWNFIELDS SITE SAMPLE I.D. NUMBER                      ROUND NO.           

SAMPLE LOCATION:                                      SITE TYPE NA DATE           

TIME START END JOB NUMBER 48400.4 FILE TYPE NA

## WATER LEVEL / PUMP SETTINGS

MEASUREMENT POINT  
☐ TOP OF WELL RISER  
☐ TOP OF PROTECTIVE CASING  
☐ OTHER                     

PROTECTIVE CASING STICKUP (FROM GROUND)            FT

PROTECTIVE CASING / WELL DIFFERENCE            FT

INITIAL DEPTH TO WATER            FT

WELL DEPTH (TOR)            FT

PID AMBIENT AIR            PPM

WELL DIAMETER            IN

FINAL DEPTH TO WATER            FT

SCREEN LENGTH            FT

PID WELL MOUTH            PPM

WELL INTEGRITY: CAP YES NO N/A  
 LOCKED                                   
 COLLAR                                 

DRAWDOWN VOLUME            GAL  
 (initial - final x 0.16 (2-inch) or x 0.65 (4-inch))

RATIO OF DRAWDOWN VOLUME TO TOTAL VOLUME PURGED           

PRESSURE TO PUMP            PSI

TOTAL VOL. PURGED            GAL  
 (purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)

REFILL TIMER SETTING           

DISCHARGE TIMER SETTING           

See pg 1

## PURGE DATA

TIME	DEPTH TO WATER (ft)	PURGE RATE (ml/m)	TEMP. (deg. c)	SPECIFIC CONDUCTANCE (umho/cm)	pH (units)	DISS. O2 (mg/L)	TURBIDITY (ntu)	REDOX (mv)	PUMP INTAKE DEPTH (ft)	COMMENTS
925	7.20	↑	13.2	.504	6.25	1.25	88	136.2	13.5	Turbidity fluctuates
930	7.13	↑	13.2	.504	6.25	1.09	98	134.2	1	
940	6.90	↓	12.8	.487	6.30	2.28	104	136.2	1	← Dumped probe container to see if turbidity is due to residuals in container
945	6.92	370	12.9	.503	6.22	1.80	99	132.9	✓	
Rechecked →										

## EQUIPMENT DOCUMENTATION

TYPE OF PUMP  
☐ QEQ BLADDER  
☐ SIMCO BLADDER  
☐ OTHER                     

TYPE OF TUBING  
☐ TEFLON OR TEFLON LINED  
☐ HIGH DENSITY POLYETHYLENE  
☐ OTHER                     

TYPE OF PUMP MATERIAL  
☐ POLYVINYL CHLORIDE  
☐ STAINLESS STEEL  
☐ OTHER                     

TYPE OF BLADDER MATERIAL  
☐ TEFLON  
☐ OTHER                     

## ANALYTICAL PARAMETERS

To Be Collected

METHOD NUMBER  
☐ VOC 8260B  
☐ SVOC CLP  
☐ TPH -GRO CLP  
☐ TPH-DRO CLP  
☐ Other                       
☐ Other                       
☐ Other                     

PRESERVATION METHOD  
☐ HCL / 4 DEG. C  
☐ 4 DEG. C  
☐ HCL / 4 DEG. C  
☐ 4 DEG. C

VOLUME REQUIRED  
☐ 3 X 40 mL  
☐ 2 X 1 L AG  
☐ 3 X 40 mL  
☐ 2 X 1 L AG

SAMPLE COLLECTED  
☐ VOC  
☐ SVOC  
☐ TPH -GRO  
☐ TPH-DRO  
☐ Other                       
☐ Other                       
☐ Other                     

See pg 1

## PURGE OBSERVATIONS

PURGE WATER CONTAINERIZED YES NO NUMBER OF GALLONS GENERATED           

## LOCATION SKETCH

## NOTES

SIGNATURE:                                     

Harding Lawson Associates





PROJECT	FORMER RIVERSIDE MILLS BROWNFIELDS SITE	SAMPLE I.D. NUMBER	Rm6W07XX01XX	ROUND NO.	1
FILE LOCATION:	MW99-7	SITE TYPE	NA	DATE	11/18/97
TIME	START 1327 END 1445	JOB NUMBER	48400.4	FILE TYPE	NA

WATER LEVEL / PUMP SETTINGS		MEASUREMENT POINT		PROTECTIVE CASING STICKUP (FROM GROUND)		PROTECTIVE CASING / WELL DIFFERENCE	
INITIAL DEPTH TO WATER	8.46 FT	<input checked="" type="checkbox"/> TOP OF WELL RISER			Flush FT		-0.34 FT
FINAL DEPTH TO WATER	8.71 FT	<input type="checkbox"/> TOP OF PROTECTIVE CASING		PID AMBIENT AIR	0 PPM	WELL DIAMETER	2 IN
DRAWDOWN VOLUME (initial - final x 0.16 (2-inch) or x 0.65 (4-inch))	0.04 GAL	<input type="checkbox"/> OTHER		PID WELL MOUTH	9.1 PPM	WELL INTEGRITY:	YES NO N/A
TOTAL VOL. PURGED (purge rate (milliliters per minute) x time duration (minutes) x 0.00026 gal/milliliter)	3 GAL			PRESSURE TO PUMP	PSI	CAP	X
				REFILL TIMER SETTING		LOCKED	X
						COLLAR	X
						DISCHARGE TIMER SETTING	

[illegible]

TYPE OF PUMP	TYPE OF TUBING	TYPE OF PUMP MATERIAL	TYPE OF BLADDER MATERIAL
<input type="checkbox"/> QED BLADDER	<input type="checkbox"/> TEFLON OR TEFLON LINED	<input type="checkbox"/> POLYVINYL CHLORIDE	<input type="checkbox"/> TEFLON
<input type="checkbox"/> SIMCO BLADDER	<input type="checkbox"/> HIGH DENSITY POLYETHYLENE	<input type="checkbox"/> STAINLESS STEEL	<input type="checkbox"/> OTHER <u>DNA</u>
<input checked="" type="checkbox"/> OTHER <u>whale</u>	<input checked="" type="checkbox"/> OTHER <u>PVC</u>	<input checked="" type="checkbox"/> OTHER <u>whale pump lubricates</u>	<u>very clean</u>

To Be Collected		METHOD NUMBER	PRESERVATION METHOD	VOLUME REQUIRED	SAMPLE COLLECTED
<input checked="" type="checkbox"/>	VOC	8260B	HCL / 4 DEG. C	2.3 X 40 mL	<input checked="" type="checkbox"/> VOC
<input checked="" type="checkbox"/>	SVOC	CLP	4 DEG. C	2 X 1 L AG	<input checked="" type="checkbox"/> SVOC
<input checked="" type="checkbox"/>	TPH -GRO	CLP	HCL / 4 DEG. C	2.3 X 40 mL	<input checked="" type="checkbox"/> TPH -GRO
<input checked="" type="checkbox"/>	TPH-DRO	CLP	4 DEG. C	2 X 1 L AG	<input checked="" type="checkbox"/> TPH-DRO
<input type="checkbox"/>					<input type="checkbox"/>
<input type="checkbox"/>					<input type="checkbox"/>
<input type="checkbox"/>					<input type="checkbox"/>
<input type="checkbox"/>					<input type="checkbox"/>
<input type="checkbox"/>					<input type="checkbox"/>
<input type="checkbox"/>					<input type="checkbox"/>
<input type="checkbox"/>	Other _____	_____	_____	_____	<input type="checkbox"/>
<input type="checkbox"/>	Other _____	_____	_____	_____	<input type="checkbox"/>
<input type="checkbox"/>	Other _____	_____	_____	_____	<input type="checkbox"/>

PURGE WATER CONTAINERIZED	YES	NO	NUMBER OF GALLONS GENERATED	0
------------------------------	-----	----	--------------------------------	---

Sample Time: 1415

SIGNATURE: RO [Signature]

Harding Lawson Associates



[illegible]

**APPENDIX G**

**DATA VALIDATION SUMMARY**

**DATA VALIDATION REPORT**  
**Former Riverside Mills - Rhode Island**  
**December 29, 1999**

**I. INTRODUCTION**

Data validation was completed in accordance with procedures described in the Work Plan (HLA, 1999). Validation actions were based on USEPA Region I validation guidelines (USEPA, 1996a). Samples were collected by Harding Lawson Associates, Inc., at the Former Riverside Mills Site in Providence, Rhode Island. Collection dates were 11/9/99-11/12/99, 11/15/99-11/16/99, and 11/18/99-11/19/99, and samples were submitted for analysis in four Sample Delivery Groups (SDGs): 24761, 24818, 24838, and 24860. All samples were analyzed by AMRO Environmental Laboratories Corporation located in Merrimack, NH.

The samples were analyzed for volatile organics, semivolatile organics, diesel range organics (DRO), and gasoline range organics (GRO) using USEPA SW846 (USEPA, 1996b) methods, with modifications for DRO and GRO analyses. Soil and water samples were prepared and analyzed in accordance with the following USEPA methods:

- Volatile organics - Method 8260B
- Semivolatile organics - Method 8270C
- DRO - Method 8015 (Modified)
- GRO - Method 8260B (Modified)

During the data review, analytical data summaries provided by the laboratory were evaluated including method blank results, laboratory control samples (LCSs) recovery, matrix spike/matrix spike duplicates (MS/MSDs) recovery, surrogate recovery, and trip blanks. No field duplicates were submitted for analysis. Evaluation of the raw data and transcription checks from raw data to reporting forms were not included in the review. The majority of the results were determined to be usable without qualification, and in general, data quality is interpreted to meet the data quality goals for the project. A subset of results has been qualified during validation. The following subsections summarize validation checks and actions for each analytical method.

Review of the analytical data included a complete transcription check of the hardcopy results versus the electronic deliverable results. No errors or omissions were found during the electronic deliverable review.

Laboratory sample numbers are used to discuss samples in this report. The following table cross-references the field sample identification numbers to the laboratory sample numbers:

Field Sample Identification	Laboratory Sample Number	Sample Matrix
RMQTXXXX02XX	24761-01	Aqueous
RMQS01XXXXXX	24761-02	Aqueous
RMBW02XX01XX	24761-03	Aqueous
RMQTXXXX01XX	24818-01	Solid
RMBS0307XXXX	24818-02	Solid
RMBS0208XXXX	24818-03	Solid
RMBS0104XXXX	24818-04	Solid
RMBS0106XXXX	24818-05	Solid
RMBS0408XXXX	24818-06	Solid
RMBS0909XXXX	24818-07	Solid
RMBS0508XXXX	24818-08	Solid
RMBS0608XXXX	24818-11	Solid
RMBS0708XXXX	24818-12	Solid
RMQTXXXX03XX	24818-13	Aqueous
RMBW01XX01XX	24818-14	Aqueous
RMGW03XX01XX	24838-01	Aqueous
RMGW02XX01XX	24838-02	Aqueous
RMGW01XX01XX	24838-03	Aqueous
RMGW07XX01XX	24838-04	Aqueous
RMQTXXXX04XX	24838-05	Aqueous
RMQTXXXX06XX	24860-01	Aqueous
RMGW05XX01XX	24860-02	Aqueous
RMGW09XX01XX	24860-03	Aqueous
RMGW06XX01XX	24860-04	Aqueous
RMGW08XX01XX	24860-05	Aqueous

## II. VOLATILE ORGANICS

Volatile organics analyses were performed for SDGs 24761, 24818, 24838, and 24860. All samples were prepared and analyzed within the holding time of 14 days from date of collection.

All associated method blanks were non-detect for volatile organics (aqueous detection limits 1.0-10 ug/L; soil detection limits 50-250 ug/kg).

Trip blanks submitted for soil and water matrices were non-detect for all analytes.

LCS results were provided for five volatile organic compounds: 1,1-dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene. With one exception, recoveries for

LCSs associated with all aqueous samples were within laboratory acceptance criteria of 80-120% indicating the laboratory was in control for this method. Recovery for trichloroethene in the LCS analyzed on 11/28/99 was 197%. LCS 11/28/99 is associated with samples for which trichloroethene is non-detect; therefore, no data qualification was done.

Matrix spikes were performed on samples from SDGs 24818 and 24860. MS/MSD results were provided for five volatile organic compounds: 1,1-dichloroethene, benzene, trichloroethene, toluene, and chlorobenzene. Laboratory specified acceptance criteria were 80-120% for aqueous samples and 70-130% for soil samples. The majority of recoveries were within these limits indicating accurate determinations were made in the sample matrices. A subset of recoveries fell outside limits as indicated below:

- Recoveries for 1,1-dichloroethene and trichloroethene in the MS/MSD of aqueous sample 24860-02 were above the upper acceptance limit of 120%. Recoveries for 1,1-dichloroethene were 125% and 122%, and the result for 1,1-dichloroethene in sample 24860-02 has been qualified as estimated (J) and is interpreted to have a potential high bias. Recoveries for trichloroethene were greater than 5000%, but the unspiked sample result was significantly greater than the spike concentration. Therefore, the spike concentration could not be distinguished from the sample concentration, and no data qualification was done.
- Recovery for trichloroethene in the MS of aqueous sample 24860-05 was above the upper acceptance limit of 120%. MS/MSD recoveries were 141% and 104%, with an RPD of 29% (RPD limit = 25%). The trichloroethene result for sample 24860-05 has been qualified as estimated (J) and is interpreted to have a potential high bias.
- Recoveries for trichloroethene in the MS/MSD of soil sample 24818-02 were 55% and 74%, and the unspiked sample result was significantly greater than the spike concentration. Therefore, the spike concentration could not be distinguished from the sample concentration, and no data qualification was done.

Most surrogate recoveries were within limits for soils (70-130%) and waters (80-120%). The following exceptions and items were noted during review:

- Soil sample 24818-12 was analyzed as a laboratory duplicate. Recovery for one surrogate was outside limits (dibromofluoromethane at 69%) in the original sample. Analysis of 24818-12DUP had all surrogates within limits, and the results from 24818-12DUP were reported as the final results for sample 24818-12.
- The reanalysis of water sample 24838-02 (24838-02RR) was reported as the final results for this sample. Surrogate recovery for 1,2-dichloroethane-d4 in the reported reanalysis was 125%, which is above the upper limit of 120%. The surrogate recovery form lists the original analysis of sample 24838-02 as having a 1,2-

dichloroethane-d4 recovery of 96%, with all other surrogates also in criteria. The laboratory reported the reanalysis because trichloroethene was out of criteria in the batch QC associated with the original analysis, and trichloroethene was detected in the sample. Based on the out of criteria surrogate recovery, all positive results for 24838-02 have been qualified as estimated and are interpreted to have a potential slight high bias.

- The reanalysis of water sample 24860-02 (24860-02RR) was reported as the final results for this sample. Surrogate recovery for 1,2-dichloroethane-d4 in the reported reanalysis was 79%, which is below the lower limit of 80%. The surrogate recovery form lists the original analysis of sample 24860-02 as having a 1,2-dichloroethane-d4 recovery of 99%, with all other surrogates also in limits. The laboratory reported the reanalysis because trichloroethene was out of criteria in the batch QC associated with the original analysis, and trichloroethene was detected in the sample. Based on the out of criteria surrogate recovery, all positive and non-detect results for the undiluted analysis of 24860-02 have been qualified as estimated J and are interpreted to have a potential slight low bias.

For samples 24860-02, 24860-03, 24860-04, 24860-05, 24838-01, 24838-02, 24838-03, and 24838-04, reanalyses (suffix RR) of these samples have been reported as the final results. The laboratory reported the reanalyses because trichloroethene was out of criteria in the batch QC associated with the original analyses, and trichloroethene was detected in the samples.

### III. SEMIVOLATILE ORGANICS

Semivolatile organics analyses were performed for SDGs 24761, 24818, 24838, and 24860.

Samples were extracted and analyzed within the holding times (extraction within 7 days of collection for aqueous samples, extraction within 14 days of collection for soil samples, analysis within 40 days of extraction) with the following exceptions:

- Aqueous samples 24838-01, 24838-02, 24838-03, 24838-04, 24860-02, 24860-03, 24860-04, and 24860-05 were initially extracted within the holding time. Re-extractions because of sample and QC surrogate recovery problems were performed 12 days after collection. All re-extraction results, positive and non-detect, would be qualified as estimated based on expiration of the holding time. After reviewing of both sets of sample data, a decision was made by HLA to report results from the initial extractions because only the acid fractions required some data qualification (see surrogate discussion below).

Method blanks were prepared and analyzed for each sample extraction batch. Method blank results were non-detect for the samples of SDGs 24761, 24838, and 24860. The aqueous method blank associated with SDG 24818 was non-detect for all analytes. However, the soil method blank extracted on 11/18/99 contained phenanthrene (0.31 mg/kg), fluoranthene (0.34 mg/kg), and pyrene (0.33 mg/kg). The reporting limit for these compounds is 0.25 mg/kg. For the soil samples of SDG 24818, positive results at concentrations less than the action levels for these compounds have been reported as non-detect at elevated concentrations due to method blank contamination. The following sample results were qualified:

- 24818-03 - phenanthrene 1.1U mg/kg;
- 24818-07 - fluoranthene 0.35U mg/kg, pyrene 0.87U mg/kg; and
- 24818-08 - phenanthrene 0.31U mg/kg, fluoranthene 0.34U mg/kg, and pyrene 0.33U mg/kg.

LCS results were provided for the following eleven semivolatile organic compounds: phenol, 2-chlorophenol, 1,4-dichlorobenzene, n-nitrosodi-n-propylamine, 1,2,4-trichlorobenzene, 4-chloro-3-methylphenol, 4-nitrophenol, acenaphthene, 2,4-dinitrotoluene, pentachlorophenol, and pyrene. Laboratory limits were provided for spike compounds; however, a general recovery lower limit of 40% was used to determine if data qualification was done. Low recoveries were observed in aqueous samples for acid fraction compounds indicating a potential low bias for acid fraction compounds (substituted phenols) in the entire data set. The following qualification actions were made in the data set:

- The LCS recoveries associated with the samples of SDG 24761 (extraction date 11/15/99) were within laboratory control limits for all spiked analytes; however, recoveries for three acid-extractable compounds were below 40% including phenol (30%), 4-nitrophenol (16%), and pentachlorophenol (38%). Based on professional judgment phenol, 4-nitrophenol, and pentachlorophenol have been qualified as estimated (J, UJ) in samples 24761-02 and 24761-03. Results are interpreted to have a potential low bias as demonstrated by LCS recoveries below 40%.
- The LCS associated with the initial extractions of samples 24838-01 through 24838-04 and 24860-02 through 24860-05 (extraction date 11/23/99) had recoveries for four acid-extractable compounds below 40% including phenol (19%), 2-Chlorophenol (35%), 4-Nitrophenol (4%), and pentachlorophenol (15%). Based on recoveries below 40%, results for phenol, 2-chlorophenol and pentachlorophenol have been qualified as estimated (J, UJ) in samples 24838-01 through 24838-04 and 24860-02 through 24860-05. Results are interpreted to have a potential low bias as demonstrated by LCS recoveries below 40%. Based on professional judgment non-detect results for 4-nitrophenol have been qualified as rejected (R) in samples 24838-

01 through 24838-04 and 24860-02 through 24860-05. Results for 4-nitrophenol are interpreted to be unusable based on LCS recovery below 10%.

- The LCS associated with the aqueous sample 24818-14 (extraction date 11/18/99) had recoveries for two acid-extractable compounds were below 40% including phenol (29%) and 4-nitrophenol (34%). Based on professional judgment, results for phenol and 4-nitrophenol have been qualified as estimated (J, UJ) in sample 24818-14. Results are interpreted to have a potential low bias as demonstrated by LCS recoveries below 40%.

Matrix spikes were performed on samples from SDGs 24761, 24860, and 24818. MS or MS/MSD results were provided for eleven semivolatile organic compounds: phenol, 2-chlorophenol, 1,4-dichlorobenzene, n-nitrosodi-n-propylamine, 1,2,4-trichlorobenzene, 4-chloro-3-methylphenol, 4-nitrophenol, acenaphthene, 2,4-dinitrotoluene, pentachlorophenol, and pyrene. Laboratory limits were provided for spike compounds; however, a general recovery lower limit of 40% was used to determine if data qualification was done. Low recoveries were observed in aqueous samples for acid fraction compounds indicating a potential low bias for acid fraction compounds (substituted phenols) in the entire data set. The following qualification actions were made in the data set:

- Based on professional judgment phenol, 4-nitrophenol, and pentachlorophenol have been qualified as estimated (J, UJ) in sample 24761-02. Results are interpreted to have a potential low bias as demonstrated by MS recoveries below 40%.
- Based on recoveries below laboratory QC limits and/or below 40%, results for phenol and pentachlorophenol in sample 24860-05 have been qualified as estimated (J, UJ). Results are interpreted to be biased low. Based on professional judgment the 4-nitrophenol result (non-detect) has been qualified as rejected (R) in sample 24860-05. The 4-nitrophenol result is interpreted to be unusable due to MS/MSD recoveries below 10%.
- Based on professional judgment, the result for pentachlorophenol in sample 24818-08 has been qualified as estimated (J, UJ). The result is interpreted to have a potential low bias as demonstrated by MS/MSD recoveries below 40%.

Surrogate recoveries were reviewed for all analyses. Low recovery trends for acid-extractable surrogates were observed in samples and QC analyses for all data sets. As indicated below, a subset of sample results were qualified as estimated.

- Based on low surrogate recoveries and professional judgment for recoveries below 40%, results for all acid-extractable analytes in water samples 24838-02, 24838-03, 24860-02 through 24860-05, and 24818-14 have been qualified as estimated (J, UJ).



#### IV. GASOLINE RANGE ORGANICS (GRO)

GRO analyses were performed concurrently with the volatile organics analyses. A modified 8260B analysis was performed in place of Method 8015 specified in the Work Plan.

Analyses for GRO were performed for SDGs 24761, 24818, 24838, and 24860. All samples were prepared and analyzed within the holding time of 14 days from date of collection. No data qualifiers were added to the final results based on review of the QC data.

All associated method blanks were non-detect for GRO (aqueous detection limit 0.10 mg/L; solid detection limit 2.5 mg/kg).

No LCS results were submitted for any of the GRO samples. Continuing calibration results were obtained and reviewed. Continuing calibration percent difference data indicated analyses were in control.

Matrix spikes were performed on a sample from each of the following SDGs: 24818 and 24838. MS recoveries were within the laboratory specified criteria of 60-140%. Recoveries were 84% for 24818-04MS and 115% for 24838-01MS indicating good accuracy for the sample matrices.

Laboratory sample duplicates were analyzed for samples 24818-12 and 24838-05. Sample 24838-05 was identified on the chain of custody as a trip blank. GRO results for samples 24818-12 and 24838-05 and their laboratory duplicates were all non-detect for GRO.

Laboratory surrogate recovery criteria were specified as 80-120% for aqueous samples and 70-130% for soil samples. All surrogate recoveries were in criteria for the GRO analyses reported as final results; the following items were noted during review:

- Sample 24818-12 was analyzed as a laboratory duplicate. Surrogate recoveries for the original sample were in criteria (70-130%) with the exception of dibromofluoromethane at 69%. Analysis of 24818-12DUP yielded in criteria recoveries for all surrogates, and the results from 24818-12DUP were reported as the final results for sample 24818-12.

#### V. DIESEL RANGE ORGANICS (DRO)

Analyses for DRO were performed for SDGs 24761, 24818, 24838, and 24860. All samples were prepared and analyzed within the holding times (aqueous samples extracted

within 7 days of collection; soil samples extracted within 14 days of collection; analysis of extracts within 40 days of extraction).

All associated method blanks were non-detect for DRO (aqueous detection limit 1.0 mg/L; soil detection limit 50 mg/kg).

LCS/LCSD results were provided for all aqueous samples, with one exception. No LCS results were provided for the aqueous sample 24818-14 extracted on 11/18/99. All reported aqueous LCS/LSCD recoveries were within laboratory limits of 60-140%. Actual recoveries ranged from 70% to 95%.

LCS results were provided for all soil samples. The soil LCS recovery was 92%, well within the limits of 60-140%.

MS/MSDs were performed on two samples from SDG 24818. MS/MSD recoveries were within the laboratory specified limits of 60-140%. Recoveries were 91% and 89% for 24818-12MS/MSD and 138% and 115% for 24818-08MS/MSD.

MS/MSDs were not reported for any of the aqueous samples.

Laboratory surrogate (o-terphenyl) recovery criteria were specified as 60-120% for aqueous samples and 60-140% for soil samples. Aqueous limits were stated in the report to have been statistically derived from laboratory data.

All surrogate recoveries were in criteria for the DRO analyses reported as final results, with two exceptions:

- The reported DRO result for soil sample 24818-11 was from a re-extraction for which the surrogate recovery was 56%. No information regarding the original extraction of 24818-11 was provided in the report. The final result for 24818-11 has been qualified as estimated (J) and is interpreted to have a potential low bias.
- The reported DRO result for aqueous sample 24761-03 was from a 1:5 dilution for which the surrogate recovery was 12%. The surrogate recovery for the initial undiluted analysis of sample 24761-03 was 20%. The final result for 24761-03 has been qualified as estimated (J) and is interpreted to have a potential low bias. It was also noted that although the report stated the final result was from a 1:5 dilution, the reporting limit provided on the final report does not reflect a dilution. In the tabulated electronic data the reporting limit has been adjusted from 1.0 mg/L to 5.0 mg/L to reflect the 1:5 dilution.

It was also noted that the reported result for soil sample 24818-12 was from a re-extraction for which the surrogate recovery was 62%, within acceptance criteria of 60-

140%. No information regarding the original extraction of the sample was provided in the report.

**References:**

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U.S. Environmental Protection Agency (USEPA), 1996b. "Test Methods for Evaluating Solid Waste;" Laboratory Manual Physical/Chemical Methods; Office of Solid Waste and Emergency Response; Washington, DC; SW-846; November 1986; Revision 4 - December 1996.

**APPENDIX H**  
**SUMMARY OF 1999 DATA**

Appendix Table H-1  
Summary of 1999 Groundwater Analytical Data  
Providence

Parameter	RMBW01XX01XX	RMBW02XX01XX	RMGW01XX01XX	RMGW02XX01XX	RMGW03XX01XX	RMGW05XX01XX	RMGW06XX01XX	RMGW07XX01XX
<b>Volatile Organics (µg/L)</b>								
1,1,1-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
1,1-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
1,1-Dichloroethene	1 U	1 U	1 U	1.6 J	1 U	7.6 J	1 U	1 U
1,2-Dibromoethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
1,2-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
1,2-Dichloroethene (cis)	29	15	7.1	890	4.5	13000	12	17
1,2-Dichloroethene (trans)	2 U	2 U	2 U	2.5 J	2 U	61 J	2 U	2 U
1,2-Dichloropropane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U	10 U	10 UJ	10 U	10 U
Acetone	10 U	21	10 U	10 U	10 U	10 UJ	10 U	10 U
Benzene	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Bromoform	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Bromomethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Carbon Disulfide	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Carbon Tetrachloride	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Chlorobenzene	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
Chloroform	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
Dibromochloromethane	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Ethylbenzene	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Methyl-tert-butyl ether (MTBE)	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Methylene Chloride	5 U	5 U	5 U	5 U	5 U	5 UJ	5 U	5 U
Styrene	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
Tetrachloroethene	2 U	2 U	2 U	2 U	2 U	26 J	2 U	2 U
Toluene	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 UJ	1 U	1 U
Trichloroethene	20	10	3.7	2.8 J	5.2	10000	2 U	17
Vinyl Chloride	18	19	3.4	120 J	2 U	30 J	9.6	5.4
Xylene (total)	2 U	2 U	2 U	2 U	2 U	2 UJ	2 U	2 U

**Appendix H, Table H-1**  
**Summary of 1999 Groundwater Analytical Data**  
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Parameter	RMBW01XX01XX	RMBW02XX01XX	RMGW01XX01XX	RMGW02XX01XX	RMGW03XX01XX	RMGW05XX01XX	RMGW06XX01XX	RMGW07XX01XX
<b>Semivolatile Organics (µg/L)</b>								
1,2,4-Trichlorobenzene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
1,2-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
1,3-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
1,4-Dichlorobenzene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
2,4,5-Trichlorophenol	10 UJ	10 U	10 UJ	10 UJ	10 U	11 UJ	10 UJ	10 U
2,4,6-Trichlorophenol	10 UJ	10 U	10 UJ	10 UJ	10 U	11 UJ	10 UJ	10 U
2,4-Dichlorophenol	10 UJ	10 U	10 UJ	10 UJ	10 U	11 UJ	10 UJ	10 U
2,4-Dimethylphenol	10 UJ	10 U	10 UJ	10 UJ	10 U	11 UJ	10 UJ	10 U
2,4-Dinitrophenol	20 UJ	20 U	20 UJ	20 UJ	20 U	21 UJ	20 UJ	20 U
2,4-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
2,6-Dinitrotoluene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
2-Chloronaphthalene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
2-Chlorophenol	10 UJ	10 U	10 UJ	10 UJ	10 UJ	11 UJ	10 UJ	10 UJ
2-Methylnaphthalene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
2-Methylphenol	10 UJ	10 U	10 UJ	10 UJ	10 U	11 UJ	10 UJ	10 U
2-Nitroaniline	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U
2-Nitrophenol	10 UJ	10 U	10 UJ	10 UJ	10 U	11 UJ	10 UJ	10 U
3,3'-Dichlorobenzidine	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
3-Nitroaniline	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4,6-Dinitro-2-Methylphenol	20 UJ	20 U	20 UJ	20 UJ	20 U	21 UJ	20 UJ	20 U
4-Bromophenylphenyl Ether	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
4-Chloro-3-Methylphenol	20 UJ	20 U	20 UJ	20 UJ	20 U	21 UJ	20 UJ	20 U
4-Chloroaniline	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
4-Chlorophenyl-Phenylether	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
4-Methylphenol	10 UJ	10 U	10 UJ	10 UJ	10 U	11 UJ	10 UJ	10 U
4-Nitroaniline	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U
4-Nitrophenol	20 UJ	20 UJ	R	R	R	R	R	R
Acenaphthene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Acenaphthylene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Anthracene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Benzo(a)Anthracene	10 U	20	10 U	10 U	10 U	11 U	10 U	10 U
Benzo(a)Pyrene	10 U	16	10 U	10 U	10 U	11 U	10 U	10 U
Benzo(b)Fluoranthene	10 U	25	10 U	10 U	10 U	11 U	10 U	10 U
Benzo(g,h,i)Perylene	10 U	15	10 U	10 U	10 U	11 U	10 U	10 U
Benzo(k)Fluoranthene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Benzoic Acid	10 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U

**Appendix Table H-1**  
**Summary of 1999 Groundwater Analytical Data**  
**Providence**

Parameter	RMBW01XX01XX	RMBW02XX01XX	RMGW01XX01XX	RMGW02XX01XX	RMGW03XX01XX	RMGW05XX01XX	RMGW06XX01XX	RMGW07XX01XX
Benzyl Alcohol	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Bis(2-Chlorethoxy)Methane	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Bis(2-Chloroethyl)Ether	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Bis(2-Chloroisopropyl)Ether	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Bis(2-Ethylhexyl)Phthalate	10 U	20	10 U	10 U	10 U	11 U	10 U	10 U
Butylbenzylphthalate	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Carbazole	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Chrysene	10 U	20	10 U	10 U	10 U	11 U	10 U	10 U
Di-n-Butylphthalate	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Di-n-Octyl Phthalate	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Dibenzo(a,h)Anthracene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Dibenzofuran	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Diethylphthalate	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Dimethyl Phthalate	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Fluoranthene	10 U	42	10 U	10 U	10 U	11 U	10 U	10 U
Fluorene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Hexachlorobenzene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Hexachlorobutadiene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Hexachlorocyclopentadiene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Hexachloroethane	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Indeno(1,2,3-c,d)Pyrene	10 U	16	10 U	10 U	10 U	11 U	10 U	10 U
Isophorone	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
N-Nitrodiphenylamine	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
N-Nitrosodimethylamine	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
N-Nitrosodiphenylamine	20 U	20 U	20 U	20 U	20 U	21 U	20 U	20 U
Naphthalene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Nitrobenzene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Pentachlorophenol	20 UJ	20 UJ	20 UJ	20 UJ	20 UJ	21 UJ	20 UJ	20 UJ
Phenanthrene	10 U	10 U	10 U	10 U	10 U	11 U	10 U	10 U
Phenol	10 UJ	10 UJ	10 UJ	10 UJ	10 UJ	11 UJ	10 UJ	10 UJ
Pyrene	10 U	42	10 U	10 U	10 U	11 U	10 U	10 U
Other (mg/L)								
Diesel Range Organics (DRO)	1 U	4 J	1 U	1 U	1 U			1 U
Gasoline Range Organics (GRO)	0.1 U	0.59	0.1 U	0.1 U	0.1 U			0.1 U

**Appendix H, Table H-1**  
**Summary of 1999 Groundwater Analytical Data**  
**Providence**

Parameter	RMGW08XX01XX	RMGW09XX01XX	RMQS01XXXXXX	RMQTXXXX02XX	RMQTXXXX03XX	RMQTXXXX04XX	RMQTXXXX06XX
<b>Volatile Organics (µg/L)</b>							
1,1,1-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2,2-Tetrachloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1,2-Trichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethane	7.4	2 U	2 U	2 U	2 U	2 U	2 U
1,1-Dichloroethene	1 U	9.5	1 U	1 U	1 U	1 U	1 U
1,2-Dibromoethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethene (cis)	170	13000	2 U	2 U	2 U	2 U	2 U
1,2-Dichloroethene (trans)	2 U	70	2 U	2 U	2 U	2 U	2 U
1,2-Dichloropropane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
2-Butanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
2-Hexanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
4-Methyl-2-Pentanone	10 U	10 U	10 U	10 U	10 U	10 U	10 U
Acetone	10 U	10 U	10 U	120	10 U	10 U	10 U
Benzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromodichloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromoform	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Bromomethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Carbon Disulfide	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Carbon Tetrachloride	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chlorobenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloroethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Chloroform	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Chloromethane	5 U	5 U	5 U	5 U	5 U	5 U	5 U
cis-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Dibromochloromethane	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Ethylbenzene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methyl-tert-butyl ether (MTBE)	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Methylene Chloride	5 U	5 U	5 U	5 U	5 U	5 U	5 U
Styrene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
Tetrachloroethene	3.7	29	2 U	2 U	2 U	2 U	2 U
Toluene	2 U	2 U	2 U	2 U	2 U	2 U	2 U
trans-1,3-Dichloropropene	1 U	1 U	1 U	1 U	1 U	1 U	1 U
Trichloroethene	6 J	11000	2 U	2 U	2 U	2 U	2 U
Vinyl Chloride	94	36	2 U	2 U	2 U	2 U	2 U
Xylene (total)	2 U	2 U	2 U	2 U	2 U	2 U	2 U



**Appendix Table H-1**  
**Summary of 1999 Groundwater Analytical Data**  
**Providence**

Parameter	RMGW08XX01XX	RMGW09XX01XX	RMQS01XXXXXX	RMQTXXXX02XX	RMQTXXXX03XX	RMQTXXXX04XX	RMQTXXXX06XX
<b>Semivolatile Organics (µg/L)</b>							
1,2,4-Trichlorobenzene	10 U	11 U	10 U				
1,2-Dichlorobenzene	10 U	11 U	10 U				
1,3-Dichlorobenzene	10 U	11 U	10 U				
1,4-Dichlorobenzene	10 U	11 U	10 U				
2,4,5-Trichlorophenol	10 UJ	11 UJ	10 U				
2,4,6-Trichlorophenol	10 UJ	11 UJ	10 U				
2,4-Dichlorophenol	10 UJ	11 UJ	10 U				
2,4-Dimethylphenol	10 UJ	11 UJ	10 U				
2,4-Dinitrophenol	20 UJ	22 UJ	20 U				
2,4-Dinitrotoluene	10 U	11 U	10 U				
2,6-Dinitrotoluene	10 U	11 U	10 U				
2-Chloronaphthalene	10 U	11 U	10 U				
2-Chlorophenol	10 UJ	11 UJ	10 U				
2-Methylnaphthalene	10 U	11 U	10 U				
2-Methylphenol	10 UJ	11 UJ	10 U				
2-Nitroaniline	20 U	22 U	20 U				
2-Nitrophenol	10 UJ	11 UJ	10 U				
3,3'-Dichlorobenzidine	10 U	11 U	10 U				
3-Nitroaniline	20 U	22 U	20 U				
4,6-Dinitro-2-Methylphenol	20 UJ	22 UJ	20 U				
4-Bromophenylphenyl Ether	10 U	11 U	10 U				
4-Chloro-3-Methylphenol	20 UJ	22 UJ	20 U				
4-Chloroaniline	10 U	11 U	10 U				
4-Chlorophenyl-Phenylether	10 U	11 U	10 U				
4-Methylphenol	10 UJ	11 UJ	10 U				
4-Nitroaniline	20 U	22 U	20 U				
4-Nitrophenol	R	R	20 UJ				
Acenaphthene	10 U	11 U	10 U				
Acenaphthylene	10 U	11 U	10 U				
Anthracene	10 U	11 U	10 U				
Benzo(a)Anthracene	10 U	11 U	10 U				
Benzo(a)Pyrene	10 U	11 U	10 U				
Benzo(b)Fluoranthene	10 U	11 U	10 U				
Benzo(g,h,i)Perylene	10 U	11 U	10 U				
Benzo(k)Fluoranthene	10 U	11 U	10 U				
Benzoic Acid	20 U	22 U	20 U				

**Appendix H, Table H-1**  
**Summary of 1999 Groundwater Analytical Data**  
**Providence**

Parameter	RMGW08XX01XX	RMGW09XX01XX	RMQS01XXXXXX	RMQTXXXX02XX	RMQTXXXX03XX	RMQTXXXX04XX	RMQTXXXX06XX
Benzyl Alcohol	20 U	22 U	20 U				
Bis(2-Chlorethoxy)Methane	10 U	11 U	10 U				
Bis(2-Chloroethyl)Ether	10 U	11 U	10 U				
Bis(2-Chloroisopropyl)Ether	10 U	11 U	10 U				
Bis(2-Ethylhexyl)Phthalate	10 U	11 U	10 U				
Butylbenzylphthalate	10 U	11 U	10 U				
Carbazole	10 U	11 U	10 U				
Chrysene	10 U	11 U	10 U				
Di-n-Butylphthalate	10 U	11 U	10 U				
Di-n-Octyl Phthalate	10 U	11 U	10 U				
Dibenzo(a,h)Anthracene	10 U	11 U	10 U				
Dibenzofuran	10 U	11 U	10 U				
Diethylphthalate	10 U	11 U	10 U				
Dimethyl Phthalate	10 U	11 U	10 U				
Fluoranthene	10 U	11 U	10 U				
Fluorene	10 U	11 U	10 U				
Hexachlorobenzene	10 U	11 U	10 U				
Hexachlorobutadiene	10 U	11 U	10 U				
Hexachlorocyclopentadiene	10 U	11 U	10 U				
Hexachloroethane	10 U	11 U	10 U				
Indeno(1,2,3-c,d)Pyrene	10 U	11 U	10 U				
Isophorone	10 U	11 U	10 U				
N-Nitrodiphenylamine	10 U	11 U	10 U				
N-Nitrosodimethylamine	10 U	11 U	10 U				
N-Nitrosodiphenylamine	20 U	22 U	20 U				
Naphthalene	10 U	11 U	10 U				
Nitrobenzene	10 U	11 U	10 U				
Pentachlorophenol	20 UJ	22 UJ	20 UJ				
Phenanthrene	10 U	11 U	10 U				
Phenol	10 UJ	11 UJ	10 UJ				
Pyrene	10 U	11 U	10 U				
Other (mg/L)							
Diesel Range Organics (DRO)							
Gasoline Range Organics (GRO)					0.1 U		

**Appendix Table H-2**  
**Summary of Soil Analytical Data**  
**Providence**

Parameter	RMBS0104XXXX	RMBS0106XXXX	RMBS0208XXXX	RMBS0307XXXX	RMBS0408XXXX	RMBS0508XXXX	RMBS0608XXXX
<b>Volatile Organics (µg/Kg)</b>							
1,1,1-Trichloroethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,1,2,2-Tetrachloroethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,1,2-Trichloroethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,1-Dichloroethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,1-Dichloroethene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,2-Dibromoethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,2-Dichloroethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,2-Dichloroethene (cis)	33 U	28 U	23 U	790	31 U	27 U	54
1,2-Dichloroethene (trans)	33 U	28 U	23 U	24 U	31 U	27 U	34 U
1,2-Dichloropropane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
2-Butanone	330 U	280 U	230 U	240 U	310 U	270 U	340 U
2-Hexanone	330 U	280 U	230 U	240 U	310 U	270 U	340 U
4-Methyl-2-Pentanone	330 U	280 U	230 U	240 U	310 U	270 U	340 U
Acetone	330 U	280 U	230 U	240 U	310 U	270 U	340 U
Benzene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Bromodichloromethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Bromoform	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Bromomethane	67 U	57 U	46 U	49 U	61 U	54 U	68 U
Carbon Disulfide	67 U	57 U	46 U	49 U	61 U	54 U	68 U
Carbon Tetrachloride	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Chlorobenzene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Chloroethane	67 U	57 U	46 U	49 U	61 U	54 U	68 U
Chloroform	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Chloromethane	67 U	57 U	46 U	49 U	61 U	54 U	68 U
cis-1,3-Dichloropropene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Dibromochloromethane	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Ethylbenzene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Methyl-tert-butyl ether (MTBE)	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Methylene Chloride	67 U	57 U	46 U	49 U	61 U	54 U	68 U
Styrene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Tetrachloroethene	33 U	28 U	23 U	91	31 U	27 U	34 U
Toluene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
trans-1,3-Dichloropropene	33 U	28 U	23 U	24 U	31 U	27 U	34 U
Trichloroethene	270	28 U	170	6700	31 U	27 U	34 U
Vinyl Chloride	67 U	57 U	46 U	49 U	61 U	54 U	68 U
Xylene (total)	33 U	28 U	23 U	24 U	31 U	27 U	34 U

**Appendix H, Table H-2  
Summary of Soil Analytical Data  
Providence**

Parameter	RMBS0104XXXX	RMBS0106XXXX	RMBS0208XXXX	RMBS0307XXXX	RMBS0408XXXX	RMBS0508XXXX	RMBS0608XXXX
<b>Semivolatile Organics (mg/Kg)</b>							
1,2,4-Trichlorobenzene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
1,2-Dichlorobenzene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
1,3-Dichlorobenzene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
1,4-Dichlorobenzene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2,4,5-Trichlorophenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2,4,6-Trichlorophenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2,4-Dichlorophenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2,4-Dimethylphenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2,4-Dinitrophenol	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
2,4-Dinitrotoluene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2,6-Dinitrotoluene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2-Chloronaphthalene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2-Chlorophenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2-Methylnaphthalene	0.3 U	0.28 U	0.28 U	0.37	0.27 U	0.27 U	0.31 U
2-Methylphenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
2-Nitroaniline	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
2-Nitrophenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
3,3'-Dichlorobenzidine	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.32 U
3-Nitroaniline	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
4,6-Dinitro-2-Methylphenol	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
4-Bromophenylphenyl Ether	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
4-Chloro-3-Methylphenol	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
4-Chloroaniline	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
4-Chlorophenyl-Phenylether	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
4-Methylphenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
4-Nitroaniline	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
4-Nitrophenol	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
Acenaphthene	0.3 U	0.28 U	0.28 U	0.69	0.27 U	0.27 U	0.31 U
Acenaphthylene	0.3 U	0.28 U	0.3	0.26 U	0.27 U	0.27 U	0.31 U
Anthracene	0.3 U	0.28 U	0.32	1.5	0.27 U	0.27 U	0.32 U
Benzo(a)Anthracene	0.3 U	0.28 U	1.1	3.7	0.27 U	0.27 U	0.32 U
Benzo(a)Pyrene	0.3 U	0.28 U	1	2.9	0.27 U	0.27 U	0.32 U
Benzo(b)Fluoranthene	0.3 U	0.28 U	1.2	3.6	0.27 U	0.27 U	0.32 U
Benzo(g,h,i)Perylene	0.3 U	0.28 U	0.64	1.6	0.27 U	0.27 U	0.32 U
Benzo(k)Fluoranthene	0.3 U	0.28 U	0.41	1.1	0.27 U	0.27 U	0.32 U
Benzoic Acid	0.59 U	0.55 U	0.55 U	0.53 U	0.27 U	0.27 U	0.31 U

**Appendix Table H-2**  
**Summary of Soil Analytical Data**  
**Providence**

Parameter	RMBS0104XXXX	RMBS0106XXXX	RMBS0208XXXX	RMBS0307XXXX	RMBS0408XXXX	RMBS0508XXXX	RMBS0608XXXX
Benzyl Alcohol	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
Bis(2-Chlorethoxy)Methane	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Bis(2-Chloroethyl)Ether	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Bis(2-Chloroisopropyl)Ether	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Bis(2-Ethylhexyl)Phthalate	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.32 U
Butylbenzylphthalate	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.32 U
Carbazole	0.3 U	0.28 U	0.28 U	0.66	0.27 U	0.27 U	0.32 U
Chrysene	0.3 U	0.28 U	0.95	3.4	0.27 U	0.27 U	0.32 U
Di-n-Butylphthalate	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.32 U
Di-n-Octyl Phthalate	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.32 U
Dibenzo(a,h)Anthracene	0.3 U	0.28 U	0.28 U	0.54	0.27 U	0.27 U	0.32 U
Dibenzofuran	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Diethylphthalate	0.3 U	0.28 U	0.28 U	0.59	0.27 U	0.27 U	0.31 U
Dimethyl Phthalate	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Fluoranthene	0.3 U	0.28 U	2.1	7.5	0.27 U	0.34 U	0.32 U
Fluorene	0.3 U	0.28 U	0.28 U	0.72	0.27 U	0.27 U	0.31 U
Hexachlorobenzene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Hexachlorobutadiene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Hexachlorocyclopentadiene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Hexachloroethane	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Indeno(1,2,3-c,d)Pyrene	0.3 U	0.28 U	0.72	1.8	0.27 U	0.27 U	0.32 U
Isophorone	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
N-Nitrodiphenylamine	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
N-Nitrosodimethylamine	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
N-Nitrosodiphenylamine	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
Naphthalene	0.3 U	0.28 U	0.28 U	1	0.27 U	0.27 U	0.31 U
Nitrobenzene	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Pentachlorophenol	0.59 U	0.55 U	0.55 U	0.53 U	0.53 U	0.53 U	0.62 U
Phenanthrene	0.3 U	0.28 U	1.1 U	7.7	0.27 U	0.31 U	0.32 U
Phenol	0.3 U	0.28 U	0.28 U	0.26 U	0.27 U	0.27 U	0.31 U
Pyrene	0.3 U	0.28 U	2	7.5	0.27 U	0.33 U	0.32 U
Other (mg/Kg)							
Diesel Range Organics (DRO)	84	85	730	220	460	1700	62 UJ
Gasoline Range Organics (GRO)	3.3 U	2.8 U	130	2.4 U	9.2	3.5	3.4 U

**Appendix H, Table H-2  
Summary of Soil Analytical Data  
Providence**

Parameter	RMBS0708XXXX	RMBS0909XXXX	RMQTXXXX01XX
<b>Volatile Organics (µg/Kg)</b>			
1,1,1-Trichloroethane	34 U	33 U	25 U
1,1,2,2-Tetrachloroethane	34 U	33 U	25 U
1,1,2-Trichloroethane	34 U	33 U	25 U
1,1-Dichloroethane	34 U	33 U	25 U
1,1-Dichloroethene	34 U	33 U	25 U
1,2-Dibromoethane	34 U	33 U	25 U
1,2-Dichloroethane	34 U	33 U	25 U
1,2-Dichloroethene (cis)	1300	33 U	25 U
1,2-Dichloroethene (trans)	34 U	33 U	25 U
1,2-Dichloropropane	34 U	33 U	25 U
2-Butanone	340 U	330 U	250 U
2-Hexanone	340 U	330 U	250 U
4-Methyl-2-Pentanone	340 U	330 U	250 U
Acetone	340 U	330 U	250 U
Benzene	34 U	33 U	25 U
Bromodichloromethane	34 U	33 U	25 U
Bromoform	34 U	33 U	25 U
Bromomethane	68 U	66 U	50 U
Carbon Disulfide	68 U	66 U	50 U
Carbon Tetrachloride	34 U	33 U	25 U
Chlorobenzene	34 U	33 U	25 U
Chloroethane	68 U	66 U	50 U
Chloroform	34 U	33 U	25 U
Chloromethane	68 U	66 U	50 U
cis-1,3-Dichloropropene	34 U	33 U	25 U
Dibromochloromethane	34 U	33 U	25 U
Ethylbenzene	34 U	33 U	25 U
Methyl-tert-butyl ether (MTBE)	34 U	33 U	25 U
Methylene Chloride	68 U	66 U	50 U
Styrene	34 U	33 U	25 U
Tetrachloroethene	34 U	33 U	25 U
Toluene	34 U	33 U	25 U
trans-1,3-Dichloropropene	34 U	33 U	25 U
Trichloroethene	5900	33 U	25 U
Vinyl Chloride	68 U	66 U	50 U
Xylene (total)	34 U	33 U	25 U

Appendix Table H-2  
Summary of Soil Analytical Data  
Providence

Parameter	RMBS0708XXXX	RMBS0909XXXX	RMQTXXXX01XX
<b>Semivolatile Organics (mg/Kg)</b>			
1,2,4-Trichlorobenzene	0.3 U	0.27 U	
1,2-Dichlorobenzene	0.3 U	0.27 U	
1,3-Dichlorobenzene	0.3 U	0.27 U	
1,4-Dichlorobenzene	0.3 U	0.27 U	
2,4,5-Trichlorophenol	0.3 U	0.27 U	
2,4,6-Trichlorophenol	0.3 U	0.27 U	
2,4-Dichlorophenol	0.3 U	0.27 U	
2,4-Dimethylphenol	0.3 U	0.27 U	
2,4-Dinitrophenol	0.6 U	0.54 U	
2,4-Dinitrotoluene	0.3 U	0.27 U	
2,6-Dinitrotoluene	0.3 U	0.27 U	
2-Chloronaphthalene	0.3 U	0.27 U	
2-Chlorophenol	0.3 U	0.27 U	
2-Methylnaphthalene	0.3 U	0.27 U	
2-Methylphenol	0.3 U	0.27 U	
2-Nitroaniline	0.6 U	0.54 U	
2-Nitrophenol	0.3 U	0.27 U	
3,3'-Dichlorobenzidine	0.3 U	0.27 U	
3-Nitroaniline	0.6 U	0.54 U	
4,6-Dinitro-2-Methylphenol	0.6 U	0.54 U	
4-Bromophenylphenyl Ether	0.3 U	0.27 U	
4-Chloro-3-Methylphenol	0.6 U	0.54 U	
4-Chloroaniline	0.3 U	0.27 U	
4-Chlorophenyl-Phenylether	0.3 U	0.27 U	
4-Methylphenol	0.3 U	0.27 U	
4-Nitroaniline	0.6 U	0.54 U	
4-Nitrophenol	0.6 U	0.54 U	
Acenaphthene	0.3 U	0.27 U	
Acenaphthylene	0.3 U	0.27 U	
Anthracene	0.3 U	0.27 U	
Benzo(a)Anthracene	0.3 U	0.27	
Benzo(a)Pyrene	0.3 U	0.27 U	
Benzo(b)Fluoranthene	0.3 U	0.27 U	
Benzo(g,h,i)Perylene	0.3 U	0.28	
Benzo(k)Fluoranthene	0.3 U	0.27 U	
Benzoic Acid	0.3 U	0.27 U	

**Appendix H, Table H-2**  
**Summary of Soil Analytical Data**  
**Providence**

Parameter	RMBS0708XXXX	RMBS0909XXXX	RMQTXXXX01XX
Benzyl Alcohol	0.6 U	0.54 U	
Bis(2-Chlorethoxy)Methane	0.3 U	0.27 U	
Bis(2-Chloroethyl)Ether	0.3 U	0.27 U	
Bis(2-Chloroisopropyl)Ether	0.3 U	0.27 U	
Bis(2-Ethylhexyl)Phthalate	0.3 U	0.27 U	
Butylbenzylphthalate	0.3 U	0.27 U	
Carbazole	0.3 U	0.27 U	
Chrysene	0.3 U	0.39	
Di-n-Butylphthalate	0.3 U	0.27 U	
Di-n-Octyl Phthalate	0.3 U	0.27 U	
Dibenzo(a,h)Anthracene	0.3 U	0.27 U	
Dibenzofuran	0.3 U	0.27 U	
Diethylphthalate	0.3 U	0.27 U	
Dimethyl Phthalate	0.3 U	0.27 U	
Fluoranthene	0.3 U	0.35 U	
Fluorene	0.3 U	0.27 U	
Hexachlorobenzene	0.3 U	0.27 U	
Hexachlorobutadiene	0.3 U	0.27 U	
Hexachlorocyclopentadiene	0.3 U	0.27 U	
Hexachloroethane	0.3 U	0.27 U	
Indeno(1,2,3-c,d)Pyrene	0.3 U	0.27 U	
Isophorone	0.3 U	0.27 U	
N-Nitrodiphenylamine	0.3 U	0.27 U	
N-Nitrosodimethylamine	0.3 U	0.27 U	
N-Nitrosodiphenylamine	0.6 U	0.54 U	
Naphthalene	0.3 U	0.27 U	
Nitrobenzene	0.3 U	0.27 U	
Pentachlorophenol	0.6 U	0.54 U	
Phenanthrene	0.3 U	0.27 U	
Phenol	0.3 U	0.27 U	
Pyrene	0.3 U	0.87 U	
Other (mg/Kg)			
Diesel Range Organics (DRO)	60 U	1000	
Gasoline Range Organics (GRO)	3.4 U	3.3 U	